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Ophthalmoscopic Diagnosis

for

General Practitioners and Students

By

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PREFACE

THIS little book has been written for the general physician and student, and the constant endeavor has been to be concise and practical.

I desire to express my thanks to the following publishers for their kindness in permitting reproductions of cuts from works published by them:

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G. W. J.

122 East 34th Street,
July 1, 1915.

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CHAPTER I

The Preliminary Examination

By Means of the Oblique or Focal Illumination:

This always precedes the examination with the ophthalmoscope.

Method:

We have the light (gas or electric) to the patient's right side and about twenty inches away. We focus it with a plus thirteen convex lens on the various portions of the eye. The lens must not be tilted, but must be held with the plane of its surface at right angles to the light. If it is tilted, its focus is not clear. It must be held the proper distance from the patient's eye to obtain a focus on the area under examination.

Errors frequently made are to have the light too near or to hold the lens too near the patient's eye.

What we Observe:

We note any haze in the cornea, due to active diseases (infiltrates or ulcers) or to old troubles (scars).

We also note any exudate of blood or pus in the anterior chamber and the depth of the chamber. We compare the depths of the two chambers.

We note the size and regularity of the pupil, and we test the direct and indirect reaction of each pupil.

We also look for opacities within and back of the pupil.

The Pupillary Reactions

THE DIRECT PUPILLARY REACTION:

We ask the patient to look off into the distance, and then suddenly throw the light, by means of the convex lens, into the eye examined. The pupil will get smaller if the reaction is present.

THE REACTION TO ACCOMMODATION AND CONVERGENCE:

We focus the light into the eye examined while the patient is gazing off into the distance. We still keep the light in his eye, and ask him to look at our finger, held a few inches away. If the reaction is present, the pupil will get noticeably smaller than it was while looking into the distance. If the pupil did not contract to the direct light, but got smaller only when asked to look at a near object, we have an Argyll-Robertson pupil. *An Argyll-Robertson pupil means tabes or paresis in most cases.*

THE INDIRECT OR CONSENSUAL REACTION:

This is a light reaction (a contraction). The light is thrown into one eye, while you watch the pupil of the other eye. If the pupil of the other, non-illuminated eye contracts, the reaction is present.

THE SIGNIFICANCE OF THE DIRECT AND CONSENSUAL REACTIONS:

They are not difficult to understand, if you remember that the pupillary reflex fibres go up to the brain through the retina, optic nerve, etc. (through, as it were, the eye), but return through the Third nerve to the ciliary ganglion and then to the eye (outside, as it were, the eye); impulses go up the retina, optic nerve, tracts, etc., on one side to the Third nerve nuclei, and then down through the Third nerve of the same side (the direct reaction), and also down through the Third nerve of the other side (the indirect or consensual reaction).

EXAMPLES:

I. A right eye blinded with an optic atrophy would have no direct reaction, and would cause no consensual reaction in the left eye, because the paths up through the eye to the brain are dead. But if the left eye is normal, we would get a consensual reaction in the right eye from light thrown into the

left eye, because the paths *up through the eye* of the left eye are normal, and the paths *down outside the eye* (the Third nerve) of the right eye are normal.

II. The right eye has no disease of retina, nerve, tract, etc., but the iris at its pupillary edge is almost entirely adherent to the lens from an old iritis. Here the right eye shows no direct reaction and no consensual reaction, yet it produces a consensual reaction in the normal left eye.

The Preparation for an Ophthalmoscopic Examination

Always take the tension of each eye before instilling drops. Ask the patient to close the lids and look down, while with both index fingers over the upper lid you palpate the resistance of each eye in turn.

Instill one drop of a four per cent solution of cocain hydrochloride into each eye and repeat the instillation in five minutes. Direct the patient to keep the lids constantly closed. After twenty minutes, the pupils are usually wide enough for examination. It is safe to use one drop of a two per cent solution of homatropin hydrochloride in case the cocain does not dilate sufficiently. After either cocain or homatropin, *always instill one drop of a half per cent solution of pilocarpin*

hydrochloride when the ophthalmoscopic examination is finished.

It is essential to have a dilated pupil before passing judgment on a fundus, and the pupil should always be dilated, irrespective of the age of the patient, except in cases of actual or suspected Glaucoma (increased tension). Some men do not hesitate to instill a weak mydriatic even in the presence of Glaucoma, but follow it immediately after the examination with a strong miotic (eserine sulphate, one or two per cent).

The Methods of Examination with the Ophthalmoscope

I. The Indirect Method.
II. The Direct Method.
III. The Direct-Indirect Method.

With the Indirect Method you use the ophthalmoscope and a thirteen diopter convex lens. With the other two methods you use only the ophthalmoscope (no lens).

The Indirect Method

Advantages:

(*a*) Smaller magnification than with the Direct Method, and therefore you obtain a rapid survey of the whole fundus.

(*b*) You can see through haze in the cornea, lens or vitreous better than with the Direct Method.

(*c*) The examination in cases of High Myopia (those above minus seven or eight diopters) is much easier with the Indirect Method than by the Direct Method.

(*d*) In examination of infants.

Disadvantages:

(*a*) Fine changes, especially in the macular region, cannot be seen by this method.

(*b*) Difference in level—*i.e.*, a raised nerve-head in Choked Disk or a depressed nerve-head in Glaucoma—cannot be measured.

(*c*) Fine hemorrhages in Retinitis cannot be seen.

Technique of Indirect Method

Both the light and the ophthalmoscope are to the *right*. The light (gas or electric) is to the right side of the patient's head and the ophthalmoscope is over the right eye of the observer in the examination of each eye. Use the concave mirror of your ophthalmoscope, and either no lens (the aperture) or a plus three lens in the sight hole of your ophthalmoscope. The light should be on the right side of the patient, on a level with his eyes and about six inches out from the patient's tem-

ple. With the electric ophthalmoscope, the source of light is in the ophthalmoscope.

Both patient and examiner may be standing or both sitting. The position of the patient's head and the examiner's head must be upright and exactly vis-à-vis; that is, the plane of the patient's face and the observer's face must be exactly parallel. The slightest tilting or turning of either face or head of the observer or the patient will upset the ease with which the disk is found.

The Order in the Examination of a Fundus:

We examine first the disk, then the macula and then the remaining fundus.

How to See the Left Disk:

It is best for beginners to look for the *left disk first,* since it is found more easily. With the ophthalmoscope snugly against the right eye and with the light on the right side of the patient, you begin at a distance of sixteen or eighteen inches away, asking the patient to look at your left ear while you throw the light into his left eye. Try a few times to see how quickly and well you can throw the light into the eye, and also your ability to keep the light in that eye. (Figure 1.) Now put the lens up over the patient's pupil, three inches away from the eye, when a white round area, filling about one-third of a dilated pupil, will be seen (the disk). (Figure 2.)

Fig. 1. Indirect Method—Luminous Ophthalmoscope
Preliminary Position in Examination of the Left Disk

If the position is correct, the left disk is always seen easily and without any manœuvring.

How to Hold the Convex Lens:

It should have a handle (Figure 3) and is held with the handle between the left thumb and index finger, while the second and ring fingers rest lightly on the patient's right temple or right cheek. In holding the lens before the patient's left eye, the mistake is often made of covering the right eye with your hand. This

Fig. 2. Indirect Method—Luminous Ophthalmoscope
Final Position in Examination of the Left Disk

should never be done, because the patient must have the right eye left uncovered in order to fix some object that you may name. He, of course, can fix better with his right eye, while you are flooding his left eye with light. To rest on the right cheek and push up the lens from below over the right or left eye is the better method. The lens must be held about three inches from the patient's eye, in case you are using a thirteen diopter plus lens, the one advised. Do not put it close up

Fig. 3. The Lens

against the patient's eye; this tendency is often present in a beginner and must be guarded against.

Résumé:

The ophthalmoscope is over the right eye, the light is to the patient's right side and the patient looks at your left ear.

How to See the Right Disk:

The ophthalmoscope is over your right eye and the light to the patient's right side, but the patient is told to

Fig. 4. Indirect Method—Non-luminous Ophthalmoscope
Preliminary Position in Examination of Right Disk

look about two inches to the outer side of your right ear. If the patient has undilated pupils, it is wise to direct him to look into the distance in a direction two inches out from your right ear. (With undilated pupils, the direction for the left disk is not to look at your left ear, but into the distance alongside your left ear.) (Figures 4 and 5.)

How to Get a View of the Whole Disk:

Often the disk will appear partly at one side of the pupil and you cannot get all the disk inside the pupil.

Fig. 5. Indirect Method—Non-luminous Ophthalmoscope Examination of Right Disk (Final Position)

For example: in the left eye, one-half the disk appears at the temporal side of the pupil and you wish to advance the disk to the nasal side. You have two ways of doing this—

(*a*) Push your lens in the direction you wish the disk to go. In this example, push your lens slowly towards the patient's nose. But perhaps the disk appeared at the temporal edge of your convex lens and you have no lens left to shove across to the nasal side; then you keep the lens stationary, and—

Fig. 6. Indirect Method—Luminous Ophthalmoscope Examination of Macula

(*b*) Move your head with the ophthalmoscope to the temporal side of the patient.

To Sum Up:

To get a disk in full view, you move your lens in the direction you wish the disk to go, or you move your ophthalmoscope in the opposite direction.

How to See the Macula:

Have the patient look exactly at the sight hole of the mirror of your ophthalmoscope. (Figure 6.)

Fig. 7. Indirect Method—Luminous Ophthalmoscope Examination of the Remaining Fundus

How to Examine the Remaining Fundus:

Have the patient look up and to his right and up and to his left, down and to his right and down and to his left, while you examine each area. These steps should never be omitted (first the disk, then the macula and then the remaining fundus). Men frequently examine the disk, and finding it normal, pronounce the eye-ground as a whole normal. (Figure 7.)

How to Get a Clear Image:

If there is no clouding of the media (cornea, aqueous, lens or vitreous), a blurred image is due to the observer and is overcome by varying the distance of your lens or ophthalmoscope, or both. Try first your convex lens:

(*a*) Push it nearer the eye, and if the image does not get more distinct, withdraw it farther from the eye; or—

(*b*) Keep the lens at the proper distance (three to three and one-half inches) from the patient's eye, while you approach your ophthalmoscope to the eye and withdraw it from the eye. Roughly, with Myopia the ophthalmoscope is held nearer, and with Hyperopia it is held farther away from the patient.

Corneal Reflexes:

Frequently a point of light appears on the cornea (corneal reflex) over the pupil and obstructs your view of the fundus. This reflex is overcome by slightly tilting your lens or your ophthalmoscope.

Summary of the Indirect Method:

I. It must be mastered.
II. Try for the left disk first.
III. Do not get too close with either your lens or your ophthalmoscope.
IV. First throw in your light and look for a whitish

Fig. 8.
Marple-Loring
Electric
Ophthalmoscope

area (the disk), and then put up the lens before the patient's eye.

V. See that your patient is looking in the right direction. If he is not, start all over again.

VI. Have the source of illumination (gas or electric) well back, so that you can tell whether your reflected light is on the patient's eye or not.

VII. Keep both your eyes open.

VIII. Keep both your mirror and your lens clean, otherwise you will see things (especially "Chorioiditis").

IX. Remember the image is inverted. What you see at the upper margin and above the disk is situated actually at the lower margin and below the disk.

X. It is the best method for rapidly comparing the color of the two disks.

The Direct Method

Advantages:

(*a*) A larger magnification (fourteen times) than with the Indirect Method (four times).

(*b*) Fine changes in the macula or the tiny hemor-

rhages in Bright's Retinitis, etc., can often be seen only by this method.

(*c*) Differences in level can be measured (Choked Disk, Glaucoma Cup).

(*d*) With the electric ophthalmoscope (Figure 8) a beginner can see the fundus almost immediately.

Technique of the Direct Method

To examine the right eye, the light is to the patient's right side and the ophthalmoscope is over your right eye. For the left eye, the light is to the patient's left side and the ophthalmoscope over your left eye. With the electric ophthalmoscope the source of light is, of course, in the ophthalmoscope. It is in the direct method of ophthalmoscopy that the electric ophthalmoscope has its greatest value.

To See the Disk:

Have the patient fix an object across the room that lies on a level with his eyes and a little to the nasal side of the eye examined. It is well to put two small objects on the wall for the patient to look at, each object on a level with the patient's eye, and one to the right and the other to the left of the median line. This is done to place the patient's disk in such a position that you can see it when you approach the eye with the ophthalmoscope directly from the front.

Fig. 9. Direct Method

To See the Right Disk:

Seat yourself slightly to the right of the patient with the light on the right side, about six inches out from and a little back of the patient's right ear and with the ophthalmoscope over your right eye. Direct the patient to look at the object on the wall that lies slightly to his left on a level with his eyes. You now throw the light into his pupil at a distance of six or eight inches and gradually approach his eye, moving your head up and down or from side to side, until you see a white

area. This is the disk. Now go directly towards the eye until your ophthalmoscope is within a half inch of the patient's cornea (Figure 9). Or you can ignore the white area and get the red fundus reflex at six or eight inches, and, holding it, approach the eye and then look for the disk. The disk is found by tracing a retinal vessel to the disk. Now your disk may not be in focus, so you must begin the examination with zero in the sight hole of your ophthalmoscope and your index finger on the driving wheel. Then revolve your wheel one way and see if the disk is clearer, and if it is, throw in more lenses until the image is the clearest that you can get. If your first turn made the image worse, go the other way.

A beginner always asks, "What lens must I use?" You cannot help him, for his accommodation and refraction are different from yours, and it is up to him to find out his proper lens with his index finger. A beginner frequently gets a peep at a blurred disk and then has to lose it, while he is fingering around to find the wheel that controls the lenses. Start with your mark at zero, with your index finger on the wheel and with a knowledge of what way you turn to get plus or minus lenses before your eye.

To See the Macula:

(*a*) Ask the patient to look into the hole of your mirror. The macula cannot be examined without a dilated pupil.

Fig. 10. Direct-Indirect Method

(*b*) Have the patient fix a distant object directly in front, while you approach the eye slightly from the temporal side, find the disk and then go outward about a distance equal to the diameter of two disks.

To See the Rest of the Fundus:

Have the patient look up to the right, up to the left, etc. A mistake frequently made here is that after ask-

ing the patient to look up, the examiner goes upward with his head and the ophthalmoscope.

To see the extreme anterior part (periphery) of a fundus, you must ask the patient to look in the direction you wish to examine, while you move your head in the opposite direction. For example, to see the extreme upper periphery, have the patient look far upward, while you go downward.

The Direct-Indirect Method

The concave mirror alone is used with either no lens in the ophthalmoscope or a plus three or stronger lens. You throw light into the dilated pupil at six or eight inches away and have the patient look in various directions. (Figure 10.)

Advantages:

(*a*) This is the best method for detecting a detachment of the retina.

(*b*) It is one method of finding floating opacities in the vitreous.

(*c*) High Myopia or High Hyperopia are quickly told by this method, as follows:

If, using the concave mirror and no lens, you see vessels of the fundus clearly, it is a case of either High Myopia or High Hyperopia. You now approach the eye slowly, and if the vessels and fundus

get clearer, it is a case of Hyperopia; if the reverse, Myopia.

(*d*) A black reflex from the fundus by this method will at once lead one to suspect a vitreous filled with blood or a black cataract.

CHAPTER II

The Normal Nerve-Head or Optic Disk

Definition:

It is that part of an optic nerve in front of the lamina cribrosa and enclosed by the opening in the sclera and the chorioid through which the optic nerve enters the eye.

I. Situation: It lies a little to the nasal side of the posterior pole.

II. Size: With the Direct Method it seems to be about one-quarter of an inch in diameter, yet its actual size is one and one-half millimeters. This knowledge is utilized in estimating the size of a hemorrhage or of an exudate in the fundus. For example: a hemorrhage one-half the size of the disk would be three-quarters of a millimeter in diameter. The disk looks larger in Myopia and smaller in Hyperopia with the Direct Method.

III. Color: Pink, due to three things—

The blood in the capillaries,
The gray nerve tissue,

The lamina cribrosa through which the nerve enters the eye.

IV. Form: Circular or a vertical oval.

V. Edges or Margins:

Normal edges are clear cut.

The inner or nasal edge is less distinct than the temporal border, because more nerve fibres stream over the nasal border. The nasal border is also redder.

The temporal border is more distinct, because less nerve fibres are present to obscure it and it is lighter in color for the same reason.

A narrow white band may lie to the temporal side or even surround the disk as a ring (the Scleral Ring), but it has no diagnostic importance. This Scleral Ring may not be present, yet bordering the disk at any place or all around it may be black pigment (the Chorioidal Ring).

The Chorioidal Ring: This also is of no diagnostic importance. Any pigment that seams the disk is not pathological.

Sometimes both rings are present, in which case the Chorioidal (dark) Ring is always outside the Scleral (white) Ring.

Broader bands, called Crescents, appear at the disk edges, especially to the temporal side or below. These are differentiated from the true tissue

of the normal disk by their whiter tone. (See Anomalies of Edges.)

Indistinctness of the edge or margin of the disk is a great sign of Neuritis and of Choked Disk.

VI. The Surface or Level of the Disk:

The surface of a normal disk is practically flush with the rest of the fundus, except that it has, as a rule, a depression—the Physiological Cup—which lies to the outer side of the central vessels and which looks whiter than the remaining disk with the ophthalmoscope. (See Physiological Cup.)

VII. The Vessels on the Disks:

The central artery and vein emerge at the center of the disk and divide into upper and lower papilla branches on or near the disk, and these, in turn, divide into upper nasal and upper temporal and lower nasal and lower temporal branches of the retina.

The central artery and its branches on the disk lie to the nasal side of the vein and its branches.

Macular vessels branch off from the vessels on the disk and go over the temporal border of the disk to surround the macula.

Retinal arteries and veins are easily distinguished apart. The veins are one-third larger, darker, more tortuous and have a narrow white streak along their center.

Hold on to the fact that *veins are a darker red and larger than arteries.*

Men often speak of the arteries or veins on the disk as being altered in cases in which they see nothing else pathological.

Beginners must remember that no diagnosis is made from changes in the disk vessels alone. If the vessels are pathologically changed, the disk or the retina will also show pathological changes.

Pulsation of Vessels:

Veins are often seen to pulsate on the disk just as they disappear at the edge of a physiological cup. They collapse and expand. This is a common phenomenon and not pathological.

Arterial pulse is always pathological and has been noted in—

Glaucoma,
Arteriosclerosis,
Valvular disease,
Aneurysm of the Aorta or of the Carotids,
Exophthalmic Goitre,
General anemia,
Imminent syncope,
Choked Disk,

and in Compression of the Central Artery of the retina near the disk. It occurs oftenest in Glaucoma. It is not an important sign and no diagnosis, local or general, is made from arterial pulsation alone. It is

observed best where an artery bends over a physiological or a glaucomatous cup.

The advice to press on an eye with your finger to elicit venous or arterial pulse is vicious, since blindness has been produced by persistence in this procedure.

Fig. 11.
Cilio-retinal Vessel
(Fuchs)

There are three vascular anomalies on or near the disk, but they are of no importance diagnostically. They are—

I. Cilio-retinal vessels. These are usually arteries, but may be veins. They emerge as shepherds' crooks at the edge of the disk and generally go towards the macula. (Figure 11.)

II. Optico-ciliary vessels. These are practically never seen.

III. Chorio-vaginal veins. These are chorioidal veins that leave the eye near the disk. (Figure 12.)

The Fundus of the Eye

The color of the fundus or eye-ground is due to the pigment-epithelium of the retina and the blood in the chorioid.

There are three types of the normal fundus, depend-

Fig. 12. Chorio-vaginal Veins (Haab)

ent on the relative amount of pigment in the retina and the chorioid:

I. Uniform Fundus. See Figure 13.

II. Tessellated Fundus. See Figure 14.

III. Albinotic Fundus. See Figure 15.

I. The Uniform Fundus:

In this fundus the pigment of the retina is so dense

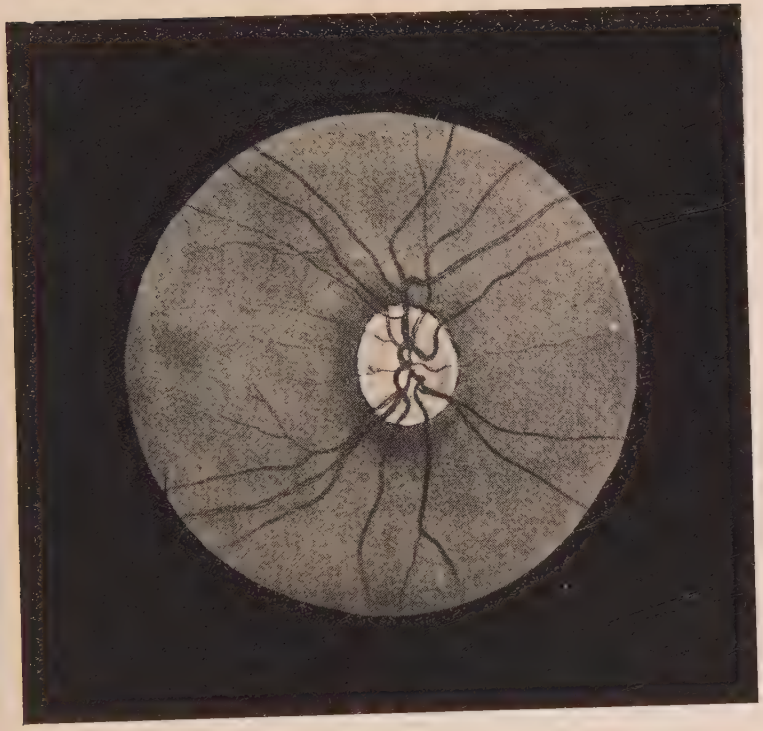

Fig. 13. Uniform Fundus (Adam)

that no chorioid is seen. (Figure 13.) This type of fundus is a dull uniform red or dark red. The dark red type is often called the negroid or brunette fundus. In a negro the optic disk looks red, due to the contrast in color. (Figure 16.)

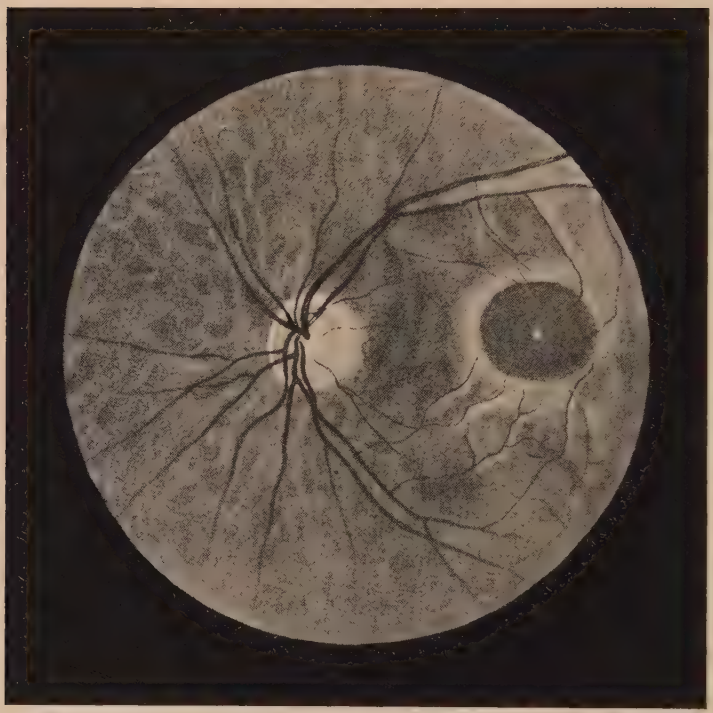

Fig. 14. Tessellated Fundus (Adam)

II. The Tessellated Fundus:

Tessellated means like mosaic, or made up of squares like a checkerboard. (Figure 14.) The retinal pigment-epithelium is so scanty that we see the chorioid vessels as red lines with the dark pigmented chorioidal interspaces enclosed. The chorioidal vessels anasto-

Fig. 15. Albinotic Fundus (Adam)

mose and enclose the intervascular spaces, which are rich in pigment. The intervascular spaces are irregular, often elongated or of a rhomboid shape. This type of fundus is *always diagnosed Chorioiditis* by beginners, a mistake that can be avoided by noting the fact that the color is not the intense black of patholog-

Fig. 16. Negroid Fundus (Fuchs)

ical pigment, and by the fact that the interspaces, while irregular, are more regular than any pathological pigmentation. The tessellated fundus may be physiological or pathological. Any disease that thins out the retinal pigment-epithelium can cause it, as—

Chorioiditis,
Glaucoma,
Myopia,
Retinitis Pigmentosa,
Retino-Chorioiditis.

In no case is a diagnosis of disease made from the finding of a tessellated fundus alone. (Figure 17.)

III. Albinotic Fundus:

Best seen in albinos, also often in blondes. (Figure

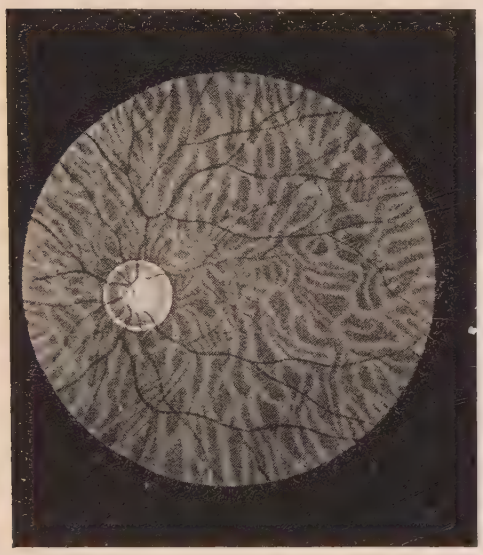

Fig. 17. Tessellated Fundus (Haab)

15.) In this type the retina and chorioid are both poor in pigment, and the sclera shows through as a light yellow background on which we see the chorioidal vessels as dark red lines. The interspaces are lighter than the chorioidal vessels, a condition the reverse of which we see in a tessellated fundus.

THE TWO TYPES OF VESSELS IN A FUNDUS ARE RETINAL AND CHORIOIDAL.

The Retinal Vessels:

(*a*) They can all be traced to the disk. This fact we

Fig. 18. Macular and Foveal Reflexes
(Fuchs)

utilize in finding the disk when we use the ophthalmoscope (Direct Method).

(*b*) The vessels are terminal, therefore they have no anastomoses and pursue a fairly straight course with tree-like branches.

(*c*) They lie nearer to you than the chorioidal vessels.

(*d*) Clearer to be seen than the chorioidal vessels.

(*e*) They have a reflex streak along their center.

The Chorioidal Vessels:

(*a*) No connection with the disk.

(*b*) Many anastomoses and irregular branching.

(*c*) Lie farther from you and you can see a retinal vessel run over them.

Fig. 19. Macular and Vascular Reflexes
(Haab)

(*d*) Less sharply defined.
(*e*) No light reflex streak.

THE NORMAL LIGHT REFLEXES OF THE FUNDUS:

These are macular, foveal and vascular.

I. The macular reflex is a whitish crescent occasionally seen at the edge of the macula. (Figure 18.)

II. The foveal reflex is a small dot or crescent seen at the very center of the macular region. This reflex

can nearly always be found with the Direct Method by having the patient look directly into the mirror.

III. The vascular reflexes are the light streaks along the center of the vessels, and also over the fundus, especially near and along the vessels. They are very confusing when one first uses the electric ophthalmoscope. Extreme cases of this vascular reflex have been described as watered silk or shot-silk fundi and are usually seen in young hyperopic individuals.

All three forms of reflexes are differentiated from pathological changes by the fact that they change their position and shape with each tilting of the ophthalmoscope, or with each increase or decrease of the amount of light thrown into the eye. (Figure 19.)

CHAPTER III

The Disk

We will now consider some of the changes that are noted in the Disk, the Vessels, the Retina and the Chorioid as congenital anomalies and in disease.

I. Anomalies of Edges:

These include the various crescents seen to the temporal side (especially in Myopia), or to any side of the disk. (Figure 20 and Figure 21.)

A white area, wider than the scleral ring, may surround the disk. It is called Circumpapillary Atrophy or Annular Staphyloma, and it occurs in—

(*a*) Normal eyes.
(*b*) Chorioiditis.
(*c*) Retinitis Pigmentosa.
(*d*) Glaucoma (the glaucomatous halo).
(*e*) Senility.
(*f*) Myopia. This is the most frequent cause.

This exposed area of sclera (Circumpapillary Atrophy), when it occurs with a normal nerve as in High Myopia or in normal eyes, is *often mis-*

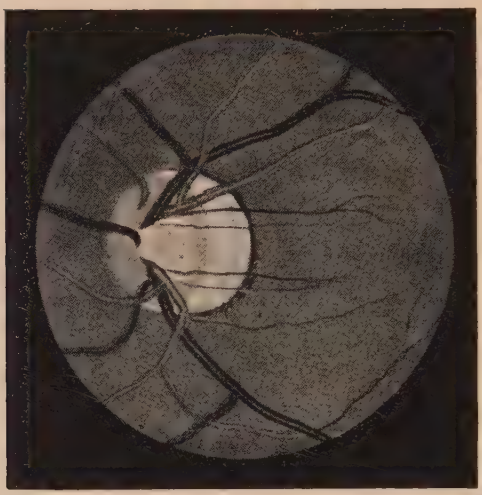

Fig. 20. Temporal Crescent (Myopia)
(Axenfeld)

taken for Optic Atrophy. This error can be avoided by noting the abnormal width of the white area, which is wider than the normal disk, and by the fact that the nerve which lies inside the white patch has its normal color. In the other forms of Circumpapillary Atrophy we find either a white nerve or changes in the Retina or Chorioid.

An early acquired anomaly that beginners regularly call Atrophy, or Neuritis, or Chorioiditis, is the condition known as *Opaque* or *Medullated Nerve Fibres.* The nerve fibres are enveloped in

Fig. 21. Congenital Inferior Crescent
(Axenfeld)

connective tissue and this appears white. Opaque nerve fibres usually begin at the edge of the disk. In rare cases they lie also on the disk, even covering it. In still rarer cases they lie at a distance from the disk. In every case they are *told by their brilliant white color and their edges or endings,* which are like a white fox's tail; that is, frayed out. This is because the connective tissue persists on some fibres farther out than on others, which gives the serrated edge. If closely studied, radiations can be seen in the white patch itself. The

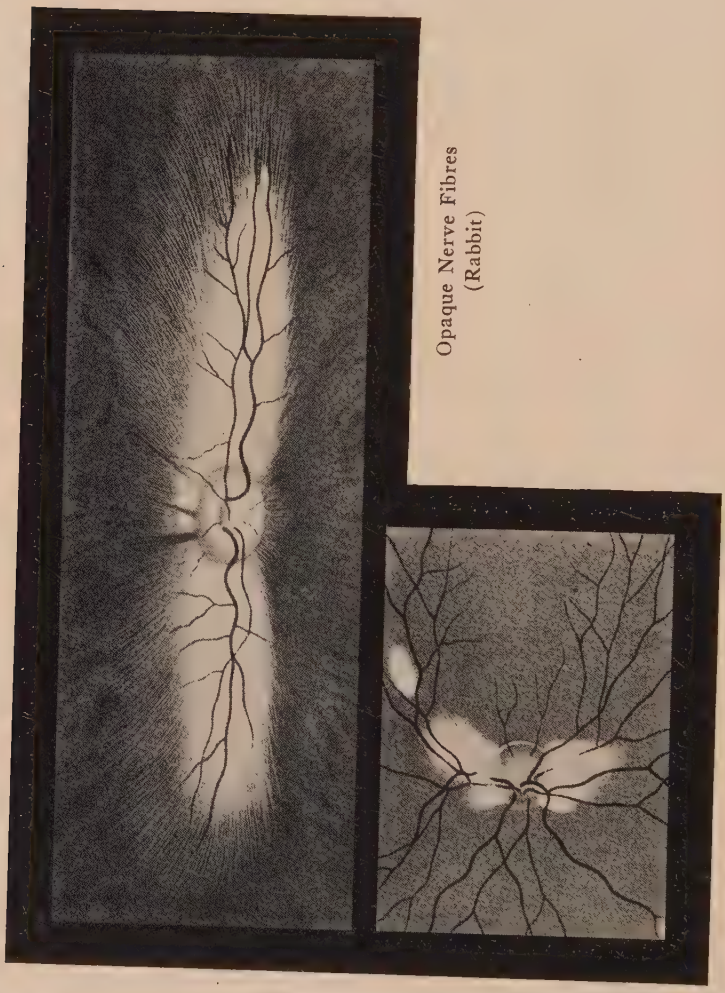

Fig. 22. Opaque Nerve Fibres (Haab)

relation of the retinal vessels has no diagnostic value, as they may be concealed entirely or run on top of the white patch of opaque fibres.

If a rabbit is available, opaque nerve fibres can be easily studied. A rabbit is very tolerant of an ophthalmoscopic examination. (Figure 22.)

The edges are blurred in Neuritis and in Post-Neuritic Atrophy.

II. Anomalies in the Shape of the Disk:

The normal disk is round or a vertical oval. It often looks as if it came into the eye sideways. This is frequently noted in high degrees of Astigmatism, and is often called Neuritis, because the edges look blurred. It is distinguished from Neuritis by the fact that each edge can be focused in turn with the proper lens in the ophthalmoscope, and when in focus shows no blur of the edges. Normal vessels and normal surrounding retina aid the diagnosis.

The Disk is broadened in Choked Disk and is smaller in Post-Neuritic Atrophy. The disk is two or three times larger than normal in Coloboma of the Optic Disk, but this congenital anomaly is extremely rare, and to fail to recognize it would be no serious error.

III. Anomalies of the Surface or Level of the Disk:

Here we have reference to a raised surface, as

in Choked Disk, or to the various depressions in the nerve-head, known as the physiological cup or excavation, the atrophic cup or excavation and the glaucomatous cup or excavation.

A cup or excavation in the disk is told usually by observing—

(*a*) Where the central vessels run over the edge of the cup. Or—

(*b*) By the parallactic displacement. Or—

(*c*) By the refraction.

How to Get a Parallactic Displacement:

Focus on the disk with the Direct Method, then move your head, with the ophthalmoscope held firmly against your cheek, slowly up and down, watching the comparative rate of movement of the edge and the center of the disk. If the center of the disk (or the bottom of what you suppose is an excavation) *moves at a different rate* from the edge of the disk, *there is a difference in level.* Practically, in an excavation both the edge of the disk and the bottom of the excavation move *with* (in the same direction as) your head, but the edge moves slower than the bottom of the excavation.

With the Indirect Method we move the lens up or down, in or out, while we keep the disk in focus. In case the disk is cupped, the edge of the cup moves faster than the bottom. The edge of the cup seems to shove itself over the bottom of the cup. Both edge and floor of the cup move with the movement of the convex lens.

AN EXCAVATION CAN ALSO BE DIAGNOSED BY REFRACTION, USING THE DIRECT METHOD, AS FOLLOWS:

With the ophthalmoscope close to your eye, focus on a retinal vessel near the disk until you find the lens that shows it most distinctly. Let us say that it is a plus seven diopter lens. Now focus in the same way the bottom of the excavation, and let us say you use now a plus four diopter lens. Then, in this case, there is an excavation or cup of three diopters, and since *three diopters' difference means one millimeter's difference in level,* you have a cup one millimeter deep. We know it is a cup, for it took less plus lens (more minus) to see the bottom of the cup than the edge of the disk.

In a Choked Disk the condition is reversed. For example: Suppose we see a normal retinal vessel near the swollen nerve with a plus one diopter lens, but we can see the top of the swollen nerve best with a plus ten diopter lens. In this case, we have a difference in focus of nine diopters, and, therefore, three millimeters of swelling.

The three types of cupping are the physiological and the two pathological cups, the glaucoma cup and the atrophic cup.

General Remarks:

In studying a cup or excavation, you must study the relation of the edge or margin of the cup to the edge of the disk (the scleral margin). There is usually no question as to what is the edge of your disk, and *a great*

guide as to the edge of your cup is where the central vessels turn over the edge of the cup; that is, either turn over the edge or actually disappear over the edge to reappear at the bottom of the cup, a little to one or to the other side. Such vessels are known as *lost* or *interrupted* vessels and only occur in glaucoma or a physiological cup, never in an atrophic cup. (The vessels are lost or interrupted in Coloboma of the Optic Disk, but this congenital anomaly is extremely rare.)

Glaucoma Cup

Now, in describing a glaucoma cup, the text books usually show a total marginal cup; that is, one in which the edge of the cup, as shown by the lost vessels, reaches *on all sides* the margin of the optic nerve (the scleral margin). See appended cut, Figure 23. In this cut there is *no nerve tissue between the edge of the cup and the edge of the disk.* It is a total or complete cup; that is, it has reached the edge on all sides.

Definition of a Glaucoma Cup:

It is not the depth and not the width that determines when an excavation is glaucomatous. *Any excavation whose margin reaches the disk margin at any point* (except temporally) *is a glaucoma excavation.* The very moment a cup becomes *marginal* at a single place, it is glaucoma. It does not have to become a total or

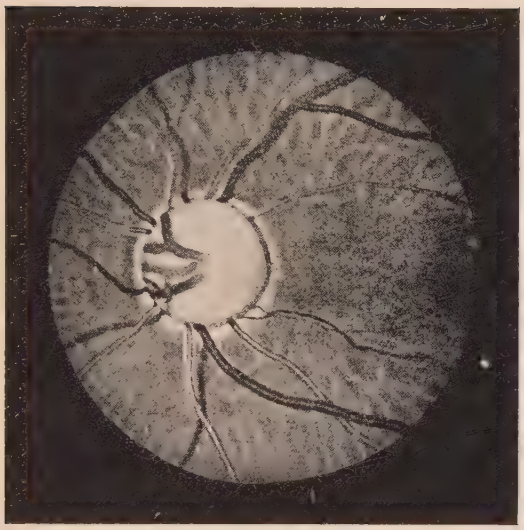

Fig. 23. Glaucoma Cup (Axenfeld)

complete marginal affair, like Figure 23 above cited, before you call it glaucoma.

> "The short bend of a single vessel immediately at the disk edge is sufficient in every case for the diagnosis of glaucoma."

Physiological Cup

The vessels may be lost at the overhanging edges, but *between the edge of the cup and the edge of the disk*

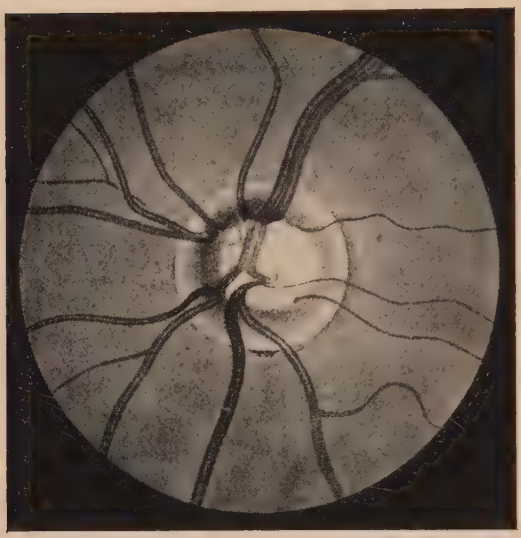

Fig. 24. Physiological Cup (Axenfeld)

there is nerve tissue; that is, the edge of the cup never reaches the edge of the disk above or below or to the nasal side. In a few cases the cup slopes gradually up to the temporal margin of the disk, and this is the one exception where a physiological cup gets to the disk edge or margin—becomes, as we say, marginal. *Large physiological cups bear watching.* (Figure 24.)

To Recapitulate:

A physiological cup can have lost vessels at its edge on any side (overhanging edge), but it can reach the

margin only temporally. Such cases have to be differentiated from glaucoma by the absence of all other signs of glaucoma.

Marginal physiological cups are usually present in each eye.

Glaucoma cups rarely reach the margin first at the temporal side; they do this usually above or below—something that a physiological cup never does. The glaucoma cup has also a white nerve.

Atrophic Cup

This cup occurs in primary atrophy of the optic nerve. It is always shallow and the vessels are never lost. It may extend to the margin of the disk, but it approaches the margin with a gradual slope; therefore the vessels are not lost in an overhanging edge. The modern theory is that an atrophic cup only occurs in eyes that possessed a large physiological cup before the optic atrophy occurred. The edges of the deep physiological cup are rounded off, as it were, by the atrophy of the fibres.

Four Types of Atrophy of the Optic Nerve Occur:

I. Primary Atrophy or Simple Atrophy.

II. Post-Neuritic (or Neuritic) Atrophy.

III. Consecutive Atrophy, which includes Atrophy after Retinitis Pigmentosa (Retinitic Atrophy), or after severe forms of Chorioiditis (Chorioiditic Atrophy).

IV. Atrophy of the papillo-macular bundle.

We will first speak of Consecutive Atrophy. In a Retinitis Pigmentosa we get a dirty-yellow disk with blurred margins and very small arteries and veins.

After Chorioiditis we often get a similar disk, but the vessels, while smaller, are not so contracted as in Retinitis Pigmentosa.

These two forms are easily diagnosed from the retinal or chorioidal diseases present.

Primary and Post-Neuritic Atrophies are distinctly different. Primary Atrophy has its great type in the so-called Gray Atrophy of Tabes; the nerve fibres atrophy, but there has been *no inflammation and therefore no exudate in the nerve-head.*

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Primary Atrophy

A typical disk shows:

Color—*gray-white or white,* but not the chalky-white of a Post-Neuritic Atrophy.

Margins—clear cut and distinct.

Vessels—normal in size and the atrophic cup with lamina cribrosa clearly seen. (Figure 25.)

Causes—Tabes, Paresis, Disseminated Sclerosis, etc.

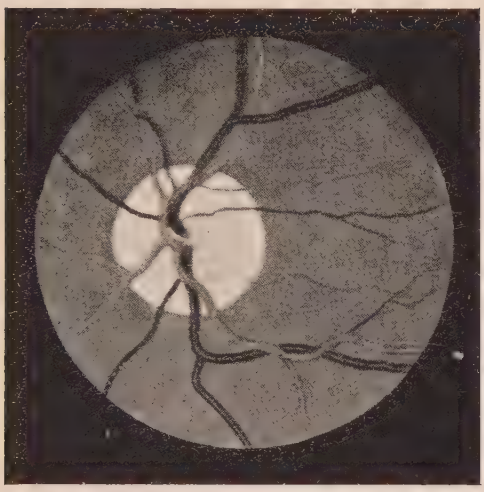

Fig. 25. Primary Atrophy (Axenfeld)

Post-Neuritic Atrophy

This is also called Neuritic, Inflammatory or Secondary Atrophy.

The word "Secondary" is also used by some authors to describe a Consecutive Atrophy.

A typical disk of Post-Neuritic Atrophy shows:

Color—very white (chalky-white).

Margins—not clear cut.

Vessels—smaller and with streaks along their sides.

The center of the disk has *no cup, but is filled in with connective tissue.* This connective tissue, which is left

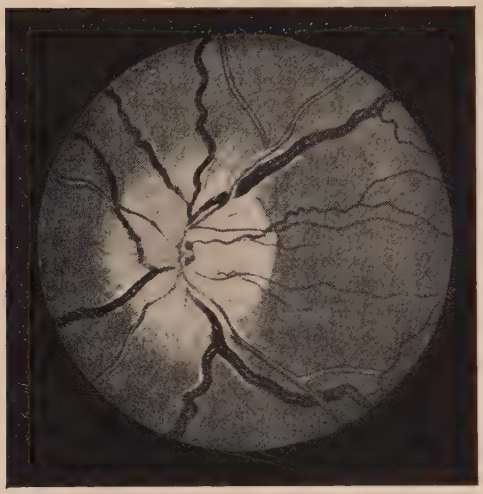

Fig. 26. Post-Neuritic Atrophy (Axenfeld)

after the neuritic exudate, causes the intense white color, the blurred edges and the streaks along the vessels. (Figure 26.)

Post-Neuritic Atrophy succeeds a Neuritis or a Choked Disk. A Choked Disk also may in rare cases be succeeded by a disk having the appearance of a simple Atrophy.

Atrophy of the Papillo-Macular Bundle

It follows Neuritis of the orbital portion of the optic nerve (Retro-Bulbar Neuritis).

This form of Atrophy is not often seen with the Ophthalmoscope. *The temporal quadrant of the disk is white* in contrast to the rest of the disk, which is of a normal color. *A physiological cup,* extending to the temporal margin, *simulates this Atrophy very closely.* The Atrophy affects only the nerve bundles that go to the macula, which lie to the outer or temporal side of the nerve-head. These cases show a blind area for all colors and for white in the center of their field of vision, or they show *a central blind area for red* (and green), either not seeing the color red at all or mistaking red for some other color. Remember these cases recognize red as red outside the central red-blind area in all meridians as far as a normal eye.

The causes are many:

Tobacco, Grain Alcohol and various Drugs, Diabetes, Multiple Sclerosis, etc.

Prognoses in the various Atrophies:

In Post-Neuritic Atrophy the prognosis as to vision is far better than in a Primary Atrophy due to Tabes, which is progressive and ultimately leads to complete blindness.

Atrophy of the Papillo-Macular bundle, if seen early, affords a favorable prognosis, as a rule.

The prognosis in Retinic and Chorioiditic Atrophy depends, of course, on the extent of the Retinitis or Chorioiditis.

Instead of cupping, we have the surface of the disk raised in:

I. Choked Disk.

II. Neuritis.

III. Pseudo-Neuritis (so-called).

Choked Disk

Definition:

When the swelling of the disk is at least two diopters —that is, the surface of the disk is raised two diopters —above the surrounding retina, we call it Choked Disk. See Parallactic Displacement.

The Fundus Picture in Choked Disk or Papilledema:

There is a sharp bending of the vessels at the edge of the swollen disk as they descend to the retina. The *disk is raised* and *widened.* There may be fine *hemorrhages on* or *near the disk,* but hemorrhages are not necessarily part of the picture.

White patches (exudates) may or may not be present. The veins are swollen and the vessels often covered over by the swollen nerve fibres, which may look like radiating streaks. *All the changes are confined to the disk and near it.*

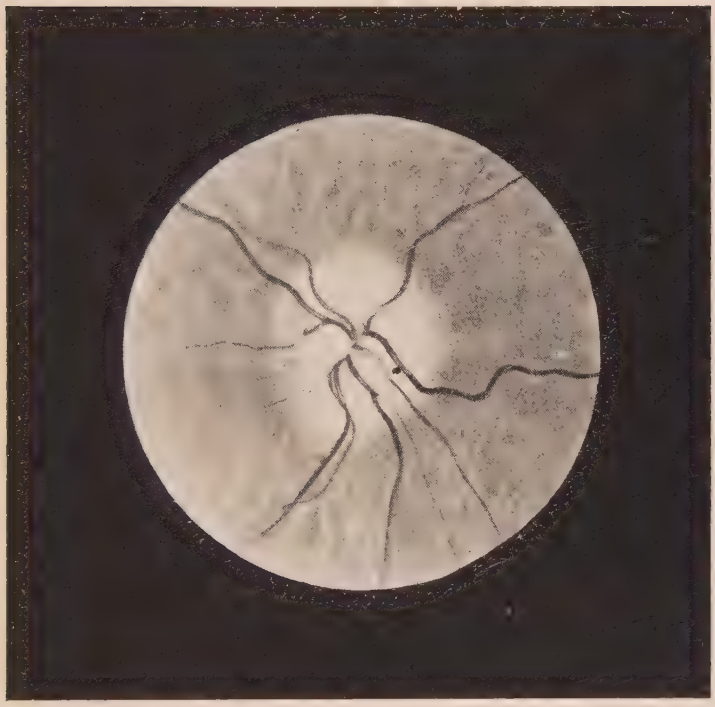

Fig. 27. Commencing Choked Disk (Adam)

The center of the Choked Disk is found by following two retinal vessels until they unite. A beginner, with his first case of Choked Disk, always says, "But I cannot see the disk."

Figure 27 shows commencing Choked Disk.

Figure 28 shows fully developed Choked Disk.

Fig. 28. Fully Developed Choked Disk (Adam)

THE SIGNIFICANCE OF A CHOKED DISK:

The finding of a typical Choked Disk in over seventy per cent of cases means a *brain tumor,* and over fifty per cent of all brain tumors cause Choked Disk. A one-sided Choked Disk is rare in brain tumor, and is, as

a rule, succeeded later by a Choked Disk on the other side. The direct vision with Choked Disk is often normal, and the *mere presence of good vision* should never preclude an ophthalmoscopic examination. (See Neuritis.)

Neuritis

The edges of the disk are the important practical point in the diagnosis of every Neuritis. *Study the edges* and see if they are blurred. With the Direct Method, always examine and *compare both disks,* slight differences of which will always give you a clue in border-line cases. Try the Parallactic Displacement and note if the disk edge is raised above the retina. Note the disk *vessels,* and see if they are wider than usual. Look for *fine hemorrhages or exudates* on the disk or in the retina. The retina is often streaked radially from the disk edge. (Figure 29, Figure 30.)

The Causes of an Optic Neuritis:

Nearly every disease, from whooping-cough and measles to a brain tumor, can cause Optic Neuritis. But the great causes are—

Brain affections,
Orbital affections, and
Syphilis.

So the presence of a Neuritis or a Choked Disk demands a Wassermann, a blood count, a urinalysis, a

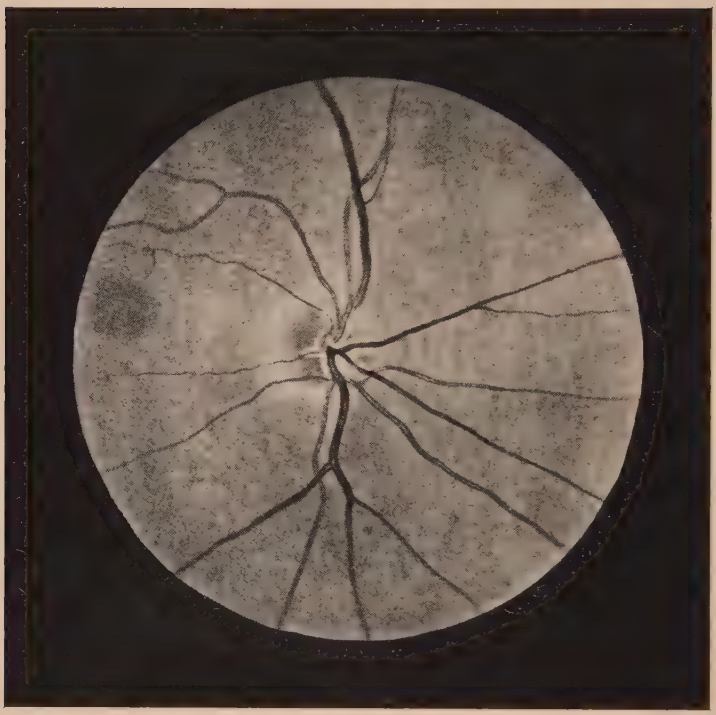

Fig. 29. Optic Neuritis (Adam)

rhinologist to examine the nasal accessory sinuses, and a neurologist.

THE TREATMENT OF CHOKED DISK AND NEURITIS:

First of all, causal, but in any case bring the patient rapidly under the influence of mercury.

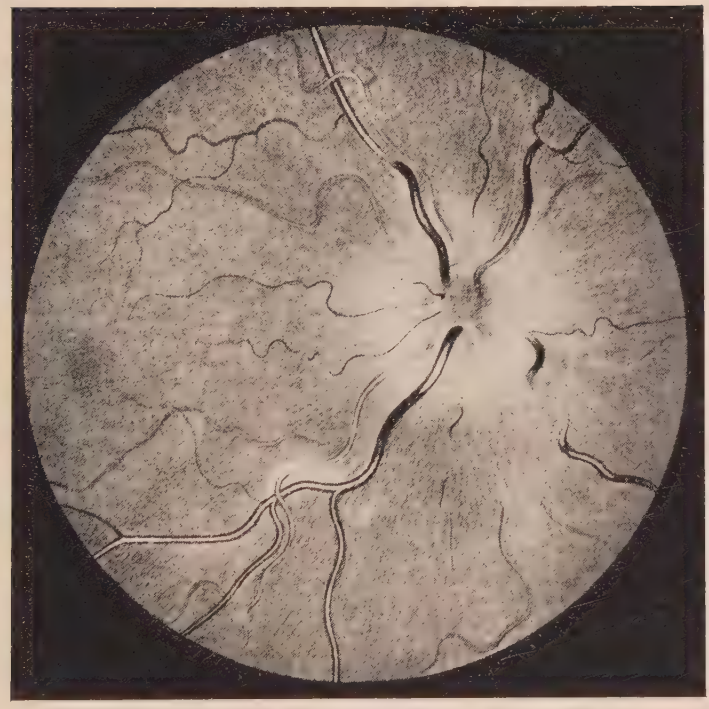

Fig. 30. Optic Neuritis (severe case) (Axenfeld)

Palliative trephining is to be considered in the inoperable tumor cases.

Pseudo-Neuritis

This is a rare condition, occurring in far-sighted eyes, in which the disk is prominent and has obscured edges.

It is diagnosed from a Choked Disk or a true Neuritis by the presence of normal vessels. *Focus carefully on a disk before you call it Pseudo-Neuritis.* Many a case of Neuritis disappears when the proper plus lens is used. *Haze in the cornea* or *vitreous* often causes the disk to look redder than normal and the negroid fundus produces the same effect. In a negroid fundus the disk looks like a blood-red sun rising out of a dense fog.

CHAPTER IV

The Retina

Ophthalmoscopic Changes in the Retina:

How do we tell whether a lesion is in the retina or in the chorioid?

I. Pigment as shown by dark spots or patches (Retinitis Pigmentosa excepted) indicates usually a chorioidal lesion.

II. A brilliant white exudate is usually retinal. Fresh Chorioiditis is yellowish-gray and old Chorioiditis dull white with pigment changes.

III. A retinal exudate or hemorrhage is usually in the macula or near the disk. Chorioiditic spots often lie in the periphery, far away from the disk and the macula.

IV. Retinal hemorrhages are often linear or striate and lie near a retinal vessel. If they lie near a retinal artery, we surmise that it is an arterial hemorrhage. If they lie near a retinal vein, we surmise that it is a venous hemorrhage.

V. Retinal exudates in the macular region are often

arranged like the radiating spokes of a wheel. This is an absolute sign of a retinal lesion.

VI. If a hemorrhage or a white spot conceals entirely a retinal vessel, it lies certainly in the retina. But a hemorrhage or an exudate over which runs a retinal vessel may lie either in the deep retinal layers or in the chorioid.

What is the Difference Between a Neuritis and a Neuro-Retinitis?

In a Neuritis the nerve and its immediate retina only are involved, while in a Neuro-Retinitis the nerve and the distant retina are involved (hemorrhages, exudates or cloudiness of the retina).

Retinal Hemorrhages are of Three General Types:

I. Striate or linear, which lie in the inner or nerve fibre layer of the retina.

II. Small round hemorrhages that lie deep in the retina or between the retina and the chorioid. Figure 31 shows hemorrhages of the first and second types.

III. Large blotches of blood that conceal the retinal vessels and that often have a horizontal upper margin. These are called *sub-hyaloid* or *pre-retinal* and lie between the retina and vitreous.

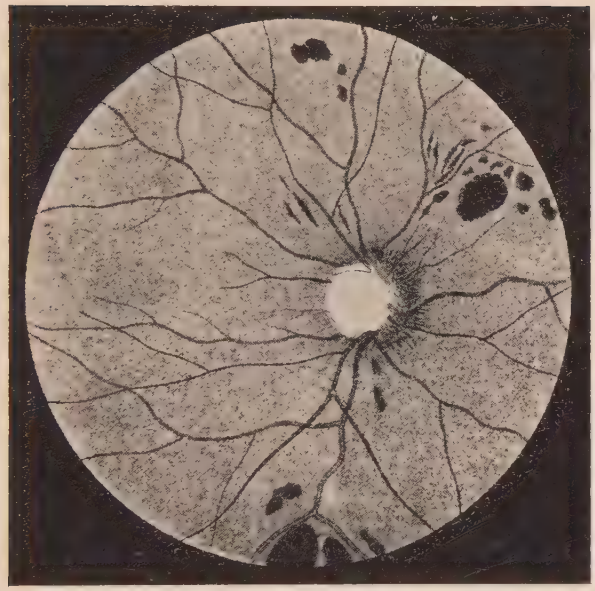

Fig. 31. Retinal Hemorrhages (Haab)

They are often due to blows and often clear up without damage to vision. Their favorite site is in or near the macular region. (Figure 32.)

A retinal hemorrhage always demands an examination of the urine and the blood.

Small retinal hemorrhages, as seen in Bright's disease, Diabetes or Arteriosclerosis, etc., are *easily overlooked.* They are best seen with the electric ophthalmoscope through a widely dilated pupil.

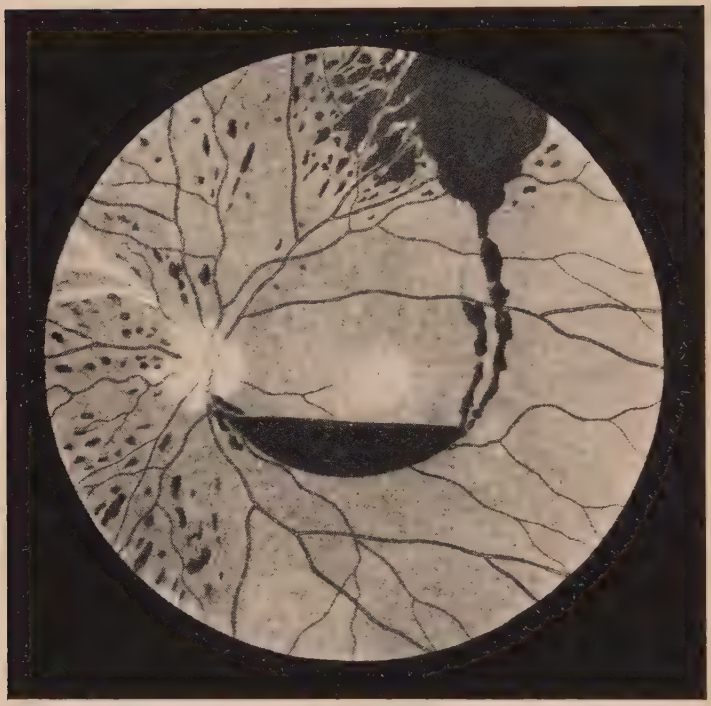

Fig. 32. Sub-hyaloid or Pre-retinal Hemorrhage (Haab)

RETINAL HEMORRHAGES ARE FOUND IN THE FOLLOWING CONDITIONS:

I. Retinitis, as Albuminuric, Diabetic, Septic, Syphilitic, etc.

II. In diseases of the blood, as Pernicious Anæmia, Chlorosis (rare), Leukæmia, Scurvy, etc.

III. Vascular diseases, as Arteriosclerosis, plugs in the Central Vein or Central Artery or their Branches.

IV. Trauma.

V. Optic Neuritis and Choked Disk, etc., etc.

Albuminuric Retinitis

Remarks:

Let it be distinctly understood that there is *no pathognomonic retinal picture of Bright's Retinitis.* The student always expects to see the star in the macula when told that he has before him a case of Albuminuric Retinitis. Also, whenever a student sees a star-shaped figure of white exudate in the macular region, he calls it Albuminuric Retinitis, although the same star-shaped or stellate figure can also occur in—

Diabetic Retinitis,
Brain Tumor,
Arteriosclerosis,
Neuro-Retinitis (due to nasal accessory sinus diseases),
Syphilitic Neuro-Retinitis,
Other conditions.

The star is characteristic and suggestive, but *not pathognomonic* of Albuminuric Retinitis.

The Characteristic Fundus in Albuminuric Retinitis Consists of—

A radiating figure in the macular region, the separate

Fig. 33. Albuminuric Retinitis (Axenfeld)

rays or spokes of which are made up of brilliant white dots or broader streaks. The center of the figure is usually free. Other white spots (exudates) occur elsewhere, especially around the nerve. Hemorrhages are also usually found near the nerve or in the macular region. The nerve is often hazy on its surface and

edges (Neuritis). The retina near the nerve is not as red as normal. Changes are almost always found in both eyes. (Figure 33.)

Diagnosis:

Because of its occurrence often at the macula with resulting poor vision, the ophthalmic surgeon first diagnoses kidney diseases in many cases. The value of the ophthalmoscope in the diagnosis of kidney diseases is shown by the fact that *often repeated urinalyses are required* before casts or albumin are found in cases where the ophthalmoscope shows retinal changes. The changes are often in the form of fine retinal hemorrhages.

Remember, then, that Renal Disease can cause retinal hemorrhages alone; or small white spots (exudates) either alone or with hemorrhages; or a neuroretinitis; or even a choked disk; or the typical stellate figure at the macula. Also remember that the diagnosis depends on the urinalysis.

Renal Retinitis has been suggested since the urinalysis often shows casts without albumin.

The Type of Kidney Lesion:

It occurs oftenest in Chronic Interstitial Nephritis, but it also occurs in the other forms of Nephritis.

Prognosis:

The majority of cases die within two years after the appearance of the fundus changes.

Albuminuric Retinitis of a *better prognosis* is that of

(*a*) Scarlet Fever,

(*b*) Pregnancy,

where the causal lesion is the kidney of pregnancy or an exacerbation of a chronic Nephritis, or, in rare cases, an acute Nephritis. In the pregnancy cases, with increasing loss of vision, the question of induced abortion or labor arises.

Retinitis Circinata

This is a *rare* condition that may be *mistaken for Albuminuric Retinitis.* A *white ring,* two or three times the diameter of the disk, *surrounds* partly or wholly *the macula.* The ring is made up of glistening white patches, in which open areas occur; they are porous, as it were. Retinal vessels run over the ring unchanged. Hemorrhages inside or near the ring are usual. The nerve is normal. The *urinalysis* is *negative.* No cause known. The condition is usually permanent. It rarely occurs under forty. In rare cases, it is bilateral. (Figure 34.)

Uræmic Amaurosis

This term means *rapidly oncoming blindness* in both eyes *in a case of Uræmia in which the fundus is normal.* The blindness is due to a cortical lesion, as shown by the pupils still contracting when the light of the ophthalmoscope is thrown into the eyes.

Fig. 34. Retinitis Circinata (Fuchs)

Prognosis:

Good as to sight which returns in a few days or weeks.

Diabetic Retinitis

This occurs in the severer cases of Diabetes Mellitus. It is characterized by *small brilliant white spots* in the macular region together with small round or streaked *hemorrhages* in the same area. The spots (exudates) rarely assume the star-shaped figure of Albuminuric

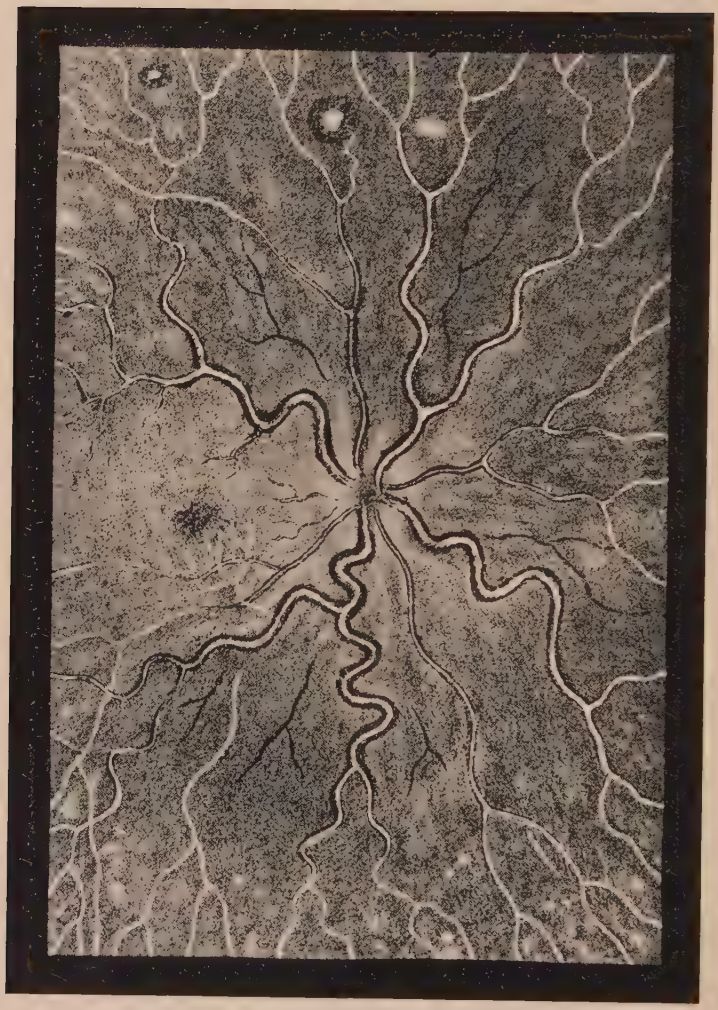

Fig. 35. Leukæmic Retinitis (Haab)

Retinitis. There is usually less cloudiness of the retina and *less cloudiness of the nerve* (Neuritis) than in Albuminuric Retinitis. The spots may be present without hemorrhages, or hemorrhages may be present without the spots.

Diagnosis:

A *urinalysis is always necessary* to determine the diagnosis. Only beginners are rash enough to say this is Albuminuric or Diabetic on the retinal findings alone. One can make a better guess by getting a whiff of the sweetish acetone breath.

Prognosis:

Not as grave as in Albuminuric Retinitis.

Leukæmic Retinitis

This type of Retinitis is characterized by *enormous veins* in a light *yellow fundus with hemorrhages,* which are white in the center and red on the outside (aggregations of white and red corpuscles). It occurs in myaloid, less often in lymphoid, leukæmia. The picture is a rare one. (Figure 35.) The appended picture shows the dilated veins and two characteristic hemorrhages.

Septic Retinitis

In general sepsis of mild or severe type Retinitis is sometimes observed. Rather large white spots, round

or oval-shaped, surround the papilla. Hemorrhages may also be present. Changes are due to small plugs in the vessels. Similar spots have been observed in scurvy.

Syphilitic Retinitis

Hemorrhages and white spots are rare. A fundus picture of a *diffuse gray cloudiness* around the nerve-head, with no hemorrhages or exudates, is very suspicious of acquired Syphilis. The nerve edges are indistinct. Syphilitic Retinitis is often associated with Iritis or Chorioiditis in the anterior or peripheral portion of the fundus. In Syphilitic Retinitis or Chorioiditis are often seen so-called *dust-like vitreous opacities*. These are best seen with a wide pupil and a plus fifteen or twenty lens, because they usually lie well forward in the vitreous. They appear as very fine dark points, as if the finest black pepper had been strewn over the red fundus. They must not be confused with posterior precipitates on the posterior surface of the cornea, which lie farther forward. (Figure 36.)

Dust-like opacities of the vitreous are extremely difficult to see—probably one of the hardest things to see with an ophthalmoscope.

The final picture of Syphilitic Retinitis is in many cases a condition called Syphilitic Retino-Chorioiditis, which simulates very closely Retinitis Pigmentosa.

Fig. 36. Syphilitic Retinitis (Haab)
(Showing the Gray Cloudiness around the Disk)

Retinitis Proliferans

Spontaneous hemorrhages into the vitreous in young persons, especially males, precede this condition. The blood fills the vitreous, giving a black pupillary reflex, and the fundus cannot be seen.

Fig. 37. Retinitis Proliferans (Adam)

After the absorption of the blood, one sees *white connective tissue masses projecting into the vitreous.* The masses lie *in front of the retinal vessels,* which can often be traced up to its base. New vessels often run on top of the mass. The mass is *usually near the disk* and may lie over the disk.

Fig. 38. Retinitis Proliferans (Fuchs)

Causes:

Connective tissue masses, running from the retina into the vitreous, have been noted in Diabetes, Syphilis and after Trauma, but the type first described refers to connective tissue masses left after recurrent retinal hemorrhages into the vitreous of unknown origin.

Diagnosis:

It is usually confused with a detached retina, but in a detachment the retinal vessels run in the clouded

area (the detachment), and the vessels are raised above the surrounding undetached retina, while in Retinitis Proliferans they lie behind the mass. (Figure 37, Figure 38.)

Retinitis Striata

White lines, more or less straight, are occasionally seen in the retina. They are the size of the retinal vessels, or slightly larger. One first thinks of an old occluded retinal vessel, and if the white line can be traced on to the disk, this is the case. Other *white lines* are seen, which may run in any direction and which lie *under the retinal vessels.* This is termed Retinitis Striata, and is differentiated from a sclerosed retinal vessel with certainty in case it pursues a course that is not directed towards the disk. The pathology of the condition is not known.

Among the diseases of vessels that cause retinal lesions, we spoke, a moment ago, of *recurrent retinal hemorrhages* (so-called Retinitis Proliferans). We will now consider two vascular lesions that cause very characteristic fundus pictures and that have an onset with sudden blindness; they are—

I. Thrombosis of the central retinal vein.

II. Embolism or Thrombosis of the central retinal artery.

Thrombosis of the Central Retinal Vein

History of sudden blindness. Vision may be the ability to count fingers.

Fundus Examination:

The beginner sees a swollen blurred nerve-head with retinal hemorrhages, and he immediately calls the condition Neuritis or Choked Disk. It may be that a Choked Disk is present, but *any Choked Disk with Hemorrhages that are not confined to the immediate vicinity of the nerve-head, but extend out all over the retina, is due to some obstruction of the venous return circulation.* There are no white spots in an early case, therefore no Diabetic or Albuminuric Neuro-Retinitis. What you have is a Neuritis (or a Choked Disk) and *a retina filled with hemorrhages in every direction.* Of course the veins are distended.

Obstruction to a branch of the central vein gives retinal hemorrhages confined to the area of the affected vein.

Causes:

Usually in elderly persons with Arteriosclerosis.

In rare cases the cause is an orbital cellulitis, due to an abscess of the lids, facial erysipelas, etc.

Treatment of the eye condition is of little avail, since the hemorrhages recur, and hemorrhagic glaucoma, due to the venous stasis, arises. (Figure 39.)

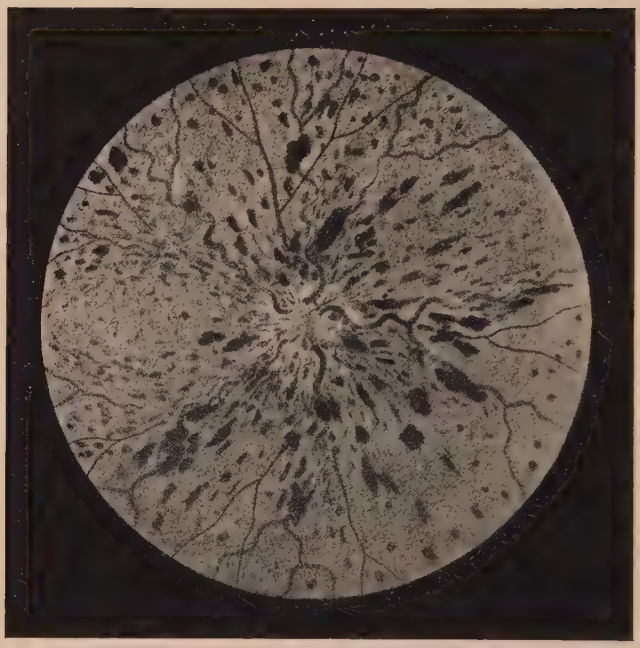

Fig. 39. Thrombosis of the Central Retinal Vein (Haab)

Obstruction of the Central Retinal Artery

Onset:

Sudden complete blindness, in which the light thrown into the eye from an ophthalmoscope is not perceived.

Ophthalmoscopic Picture:

This is characteristic. The retina all around the optic nerve and all over the macular region is of a

Fig. 40. Obstruction of Central Retinal Artery
Early Changes (Haab)

milky-white color. The red retina is seen only in the periphery of the fundus. But the characteristic thing is that in this white area there is a small red spot at the exact center of the macula. This is the so-called *cherry-red spot of the macula.* The spot varies in size and also in color. I have recently noticed it black in an embo-

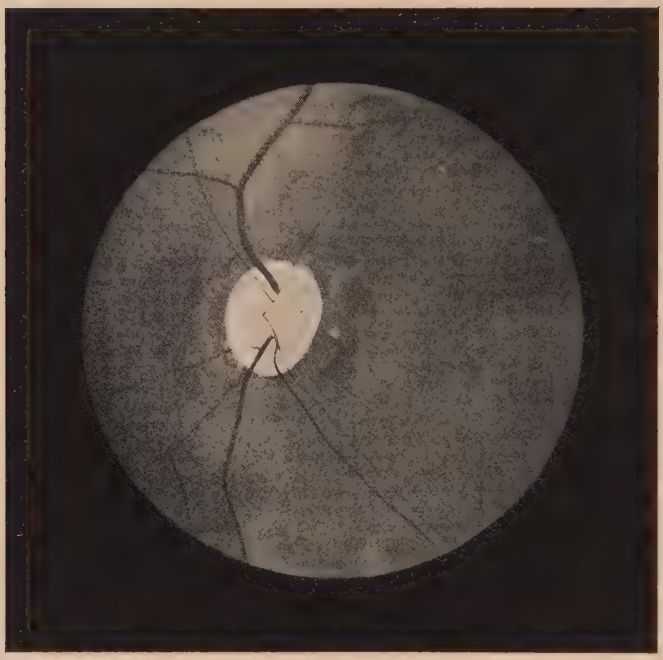

Fig. 41. Post-Embolic Atrophy (Adam)

lism occurring in the fundus of a brunette. Hemorrhages are not part of the picture and rarely occur. Of course, the arteries are cut down to fine threads.

The Final Picture:

Weeks later, the cherry-red spot fades and the retina regains its red color, but the disk looks white with very

small arteries (Post-Embolic Atrophy). Figure 40 and Figure 41 show the early and late fundus changes.

Diagnosis of a Fresh Case:

The sudden complete blindness in one eye with the finding of a cherry-red spot, without a history of Trauma, as a rule, determines the diagnosis.

Causes:

Heart disease—Endarteritis Obliterans, etc.

Treatment:

Digitalis, nitroglycerin or amyl nitrate, with deep massage of the eye, has dislodged the plug and pushed it on into a branch of the central artery in a few early cases.

Special Types:

A cilio-retinal artery has preserved a part of the retina for some time. In the appended cut the dark area shows the red retina supplied by a cilio-retinal artery. (Figure 42.)

Obstruction of a branch of the central artery causes cloudiness (œdema) of the area supplied by the branch.

The Cherry-Red Spot in the Macula

It is well to name the various conditions that can cause this picture. Remember that the red spot is the

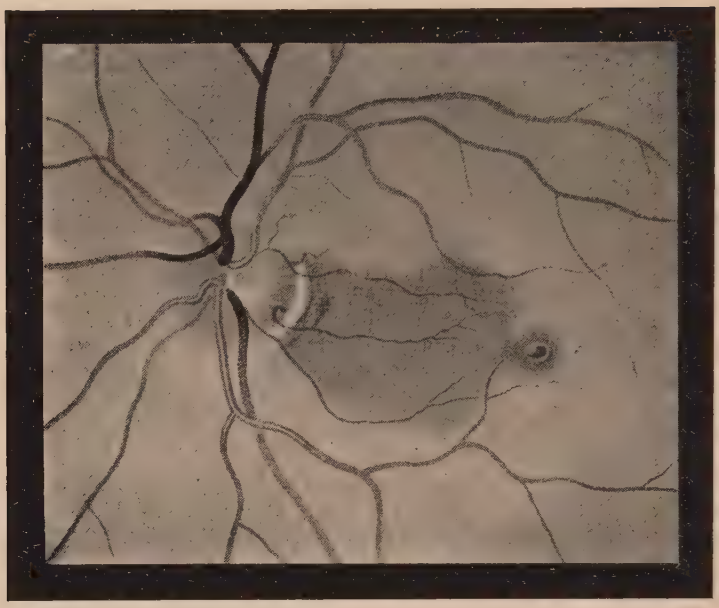

Fig. 42. Obstruction of Central Retinal Artery (Frost)

red chorioid showing through the cloudy œdematous retina, which is very thin at the fovea.

I. Any obstruction of the central retinal artery, as embolus, thrombus, endarteritis obliterans, tumors of the optic nerve-head, or hemorrhages and exudates into the nerve-head or sheath (in a few cases).

II. An injury that severs the optic nerve between the

entrance of the central artery of the retina into the nerve and the eye-ball.

III. Amaurotic family idiocy.

IV. Quinin blindness.

V. Spasm of the retinal arteries.
I have seen one such case, in which the cherry-red spot with a white retina appeared and disappeared several times within a few minutes.

VI. Commotio retinæ (traumatic œdema of the retina, Berlin's opacity).

VII. Shallow (flat) detachment of the retina in the macular region.

Amaurotic Family Idiocy

The Fundus Picture:

A milky-white area, the size of the disk or larger, with a *cherry-red spot* in its center, is seen at the macular region *in both eyes*. The rest of the fundus is normal.

Occurrence:

In children under two years of Hebrew parentage, as a rule. Often more than one child in the same family affected.

Diagnosis:

It is a form of infantile paralysis. The mother

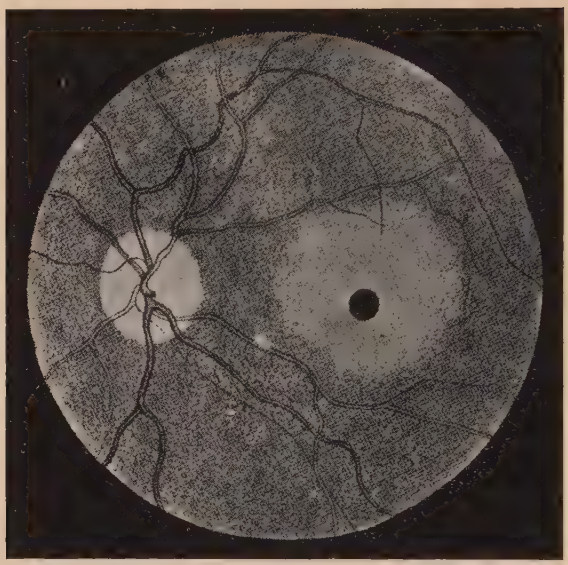

Fig. 43. Amaurotic Family Idiocy (Frost)
(Indirect Method)

notices that the child is listless and cannot hold its head up, also that the child does not notice things. The pupils may or may not be dilated, according to the stage of the disease. *Two symmetrical cherry-red spots in an infant make the diagnosis.* (Figure 43 and Figure 44.) (Indirect method.)

Outcome:

Death, which, as a rule, occurs before the third year.

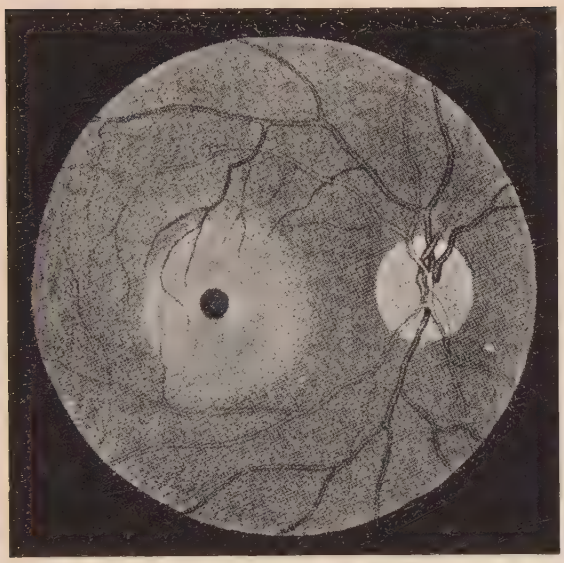

Fig. 44. Amaurotic Family Idiocy (Frost)
(Indirect Method)

Commotio Retinæ

Occurrence:

This follows a blunt Trauma to the globe, and may occur at any part of the retina, but prefers the macula.

Fundus Picture:

A milky-white area, especially in the macular region, in which case the cherry-red spot may or may not be present. Central vision may be affected slightly or greatly.

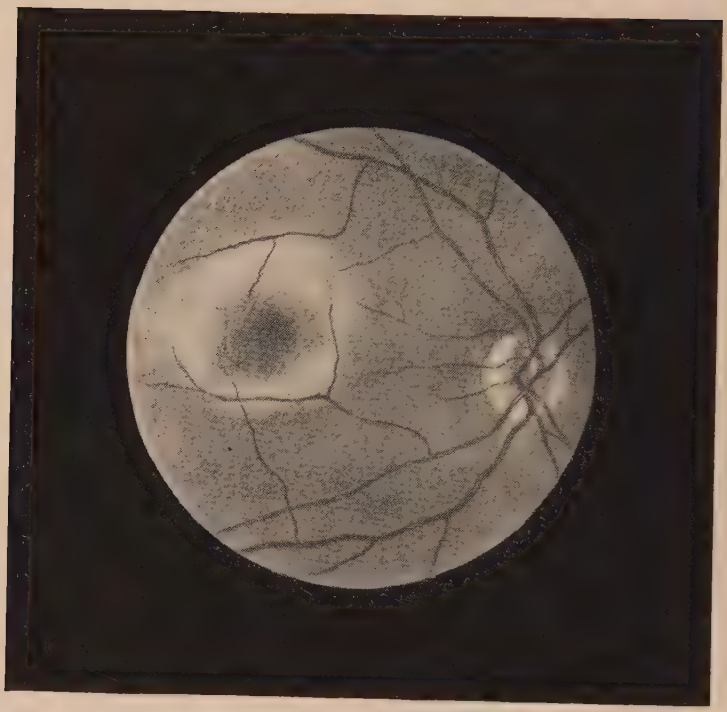

Fig. 45. Commotio Retinæ (Adam)

Outcome:

As a rule, the œdema disappears in a day or two without any damage to sight. In a few cases permanent changes (pigment, etc.) remain. The appended cut shows the macular cloudiness, but not the cherry-red spot. (Figure 45.)

Fig. 46. Shallow Detachment of the Retina at the Macula (Haab)

Shallow Detachment of the Retina at the Macula

The cherry-red spot is rare, and what we see is a cloudy whitish-gray retina with the retinal vessels darker and more tortuous over the detachment. The retina is raised only slightly from the chorioid; there-

fore the condition is hard to differentiate from conditions like Commotio Retinæ, in which the retina at the macula is œdematous, but not separated. (Figure 46.) This cut shows the condition fairly well, and also the cherry-red spot, which is rather large and not typical. The color is whiter than shown here. This detachment would be best detected at five or six inches from the eye, using only the ophthalmoscope (the Direct-Indirect Method).

Arteriosclerosis

The Fundus Changes that may be Seen Are—

Fine tortuous vessels seen, as a rule, *near the macula* or near the disk.

Besides the small twigs, the larger retinal arteries and veins are tortuous, and show *white streaks along their sides,* or an enlargement of the reflex light-streak along their center.

A vein is often pressed on by a stiff artery at their crossing, and the *vein is indented.*

The veins are often *dilated beyond the point where an artery crosses.*

The arteries at times are transformed into white lines, or an artery may be white in part of its course and red in other parts.

Hemorrhages and exudates (white spots) also occur.

The nerve is often hazy at its edges. (Figure 47.)

Fig. 47. Arteriosclerosis (Haab)

SIGNIFICANCE:

These changes are found in cases of Arteriosclerosis and Nephritis.

Tortuosity of fine vascular twigs and fine hemorrhages, discovered by the ophthalmologist, *lead often to the diagnosis of Arteriosclerosis or Nephritis.*

Many men, like Hawthorne of England, insist that every physician should be able to use the ophthalmo-

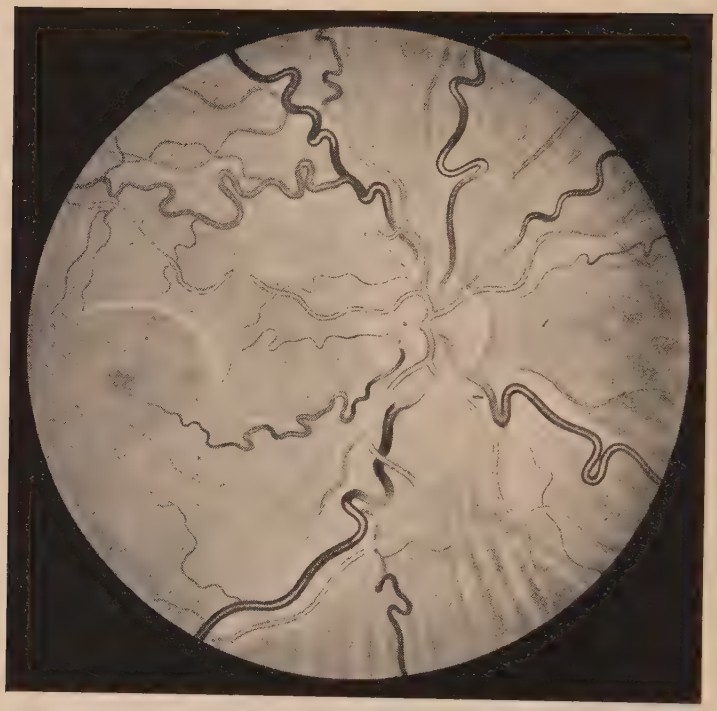

Fig. 48. Congenital Tortuosity of Retinal Vessels
(Oeller)

scope as well as the stethoscope in the examination of his patients. In Arteriosclerosis of the retinal vessels he would often find his first sign of a serious general disease, and by appropriate treatment would greatly prolong life.

Recently a man, aged fifty-five, came to the clinic with a blotch of blood under the conjunctiva of one eye (subconjunctival ecchymosis). This caused me to dilate both pupils and examine the fundus. The vessels in each eye were tortuous and many fine twigs were present. Very fine linear hemorrhages near the disk in one eye and larger hemorrhages in the other eye were also found. The man insisted that his eyes were normal, and he also insisted that he was perfectly healthy. His blood pressure was 210, and his urine showed albumin and granular casts.

Marked tortuosity of retinal vessels, especially the veins, *is sometimes seen as a congenital anomaly.* The condition is easily distinguished by the absence of other changes in the vessel wall, nerve or retina. Figure 48 shows a case of congenital tortuosity of the retinal vessels in an otherwise normal fundus.

In congenital heart disease ("blue babies") the retinal vessels are enormously enlarged, especially the veins (Cyanosis of the Retina). The dusky skin, clubbed fingers and systolic heart sound make the diagnosis. The fundus picture is unique.

Retinitis Pigmentosa

When a person complains of seeing much worse towards night (night blindness), it is well to examine the fundus.

Fig. 49. Retinitis Pigmentosa (Haab)

A Typical Picture:

Shows coal-black pigment over the whole periphery of both fundi. The pigment is delicate and interlacing and lies over the retinal vessels. Not until late in the disease does it get near the nerve or macula. The vessels are small and the nerve is of a dirty yellow color (Retinitic Atrophy). The fundus is tessellated and dull in color (leaden fundus). There are no white patches. (Figure 49.)

Diagnosis:

Its differentiation from old Retino-Chorioiditis Syphilitica is often very difficult. The pigment in each case may look the same, but round white areas (exposed sclera) and vitreous opacities occur in Retino-Chorioiditis and not in Retinitis Pigmentosa (except very rarely).

Retinitis Pigmentosa, being hereditary, is bilateral and symmetrical, while Syphilitic Chorio-Retinitis, due to acquired (rarely hereditary) Syphilis, may affect one eye only, or one eye far more than the other.

In Syphilitic Retino-Chorioiditis the vessels and nerve are less affected, and night blindness is not so marked.

In a dark room, with illumination enough for a normal eye to see fingers at ten feet away, the Retinitis Pigmentosa case cannot see them before his nose, and he also, when asked to look at your nose, cannot see your fingers moved in from the side until they get nearly

in his line of vision (marked contraction of his visual field in reduced light). He may get around well during the day, but begs to be allowed to leave the clinic so as to get home before it gets dark. This night blindness is by no means so extreme in Retino-Chorioiditis.

Retinitis Pigmentosa without Pigment:

This very rare condition has the tessellated leaden fundus, small vessels, dirty yellow nerve and the night blindness of Retinitis Pigmentosa, but no pigment changes are seen.

Retinitis Pigmentosa, with and without pigment, begins about puberty and is often hereditary. Consanguinity obtains in a third of the cases.

Outlook in Both Types:

Blindness after many years.

Ophthalmia Hepatica

In *chronic liver diseases* night blindness occurs in a few cases, with a fundus pigmented as in Retinitis Pigmentosa.

Siderosis Bulbi

Retained pieces of steel or iron in the globe cause night blindness and pigmentation of the retina like Retinitis Pigmentosa. They stain the iris a dirty rust color, and *two irides of a different color* (that is, one blue or gray and the other rusty brown) always should

lead to an inquiry regarding injury with a foreign body. In case the difference in color has not existed from early childhood, an X-ray picture should be taken.

Prognosis:

Such an eye is dangerous to the other eye and usually requires enucleation.

Retinitis Punctata Albescens

This very rare form of Retinitis is allied to Retinitis Pigmentosa. Great numbers of small white or yellowish white spots are distributed over the fundus. There are no other changes. It begins in early childhood with night blindness. It is bilateral and does not progress.

Detachment of the Retina

Ophthalmoscopic Examination:

This is best made with the ophthalmoscope alone at four to six inches from the eye (Direct-Indirect Method). Have the patient look up, down, in and out, while you compare the color of the fundus in the various areas examined. A detachment is suspected the very moment you find an area that is grayer than the rest of the fundus. Now look at this area, varying your distance from the eye and the strength of your lens. If it is a detachment, you will see dark vessels on your

cloudy area, which look nearer to you than the rest of the fundus. You may also see whiter streaks, which are the folds of the detached retina. You can go close and focus on this area, in which case you can see that the vessels are tortuous, wavy and darker over the detached area. You also will use a stronger plus lens to see the detachment than you use for the undetached retina of the rest of the eye.

Now prove your detachment: Have the patient look at your nose, while you try out whether he sees your fingers opposite to where you believe the detachment is.

Suppose you believe that the retina is detached all below the disk. In this case ask the patient to look at your nose with the other eye covered, and if your diagnosis is correct he will not see your fingers moving anywhere above his line of vision to your nose. Yet in such a detachment the patient will usually say, "I see only the lower part of people when I look at them with one eye."

Causes:

High degrees of Near-Sightedness, Trauma, Tumor, etc.

The Importance of a Detached Retina:

The finding of a detached retina always calls for transillumination of the detachment with a Sachs' Lamp to determine what lies behind the detachment. Behind many detachments are malignant tumors that demand

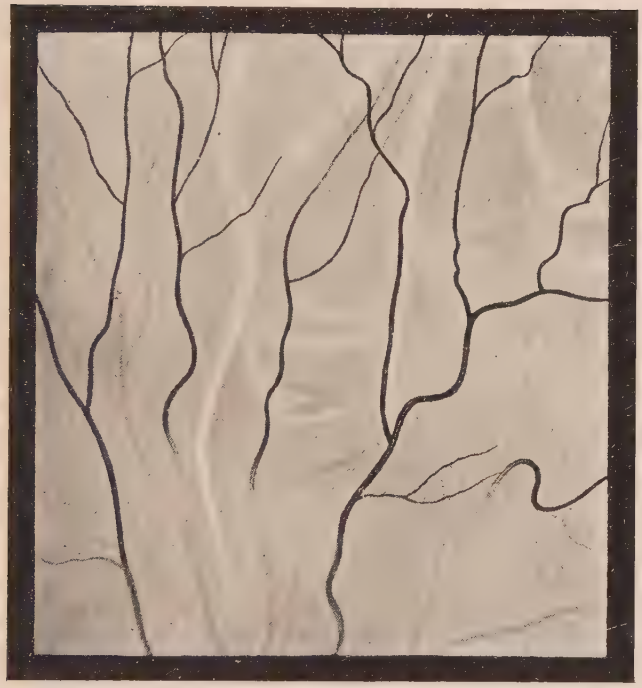

Fig. 50. Detachment of Retina (Frost)

speedy enucleation of the eye. If only serum or, at most, blood is behind the detachment, we speak of it as a *simple* or *serous detachment.* (Figures 50 and 51.)

WARNING:

Suspect every detachment until you prove it innocent with a transilluminator.

Fig. 51. Detachment of Retina (Frost)

Glioma of the Retina

The mother usually brings her child with *a white* or *yellowish reflex from far back in the pupil.* The tumor mass that causes this reflex is not on a level with the plane of the iris, but back of the crystalline lens, and is seen best with the light of a lamp focused on the eye with your convex lens.

Diagnosis:

This tumor usually appears before the fifth year, and any reflex, as described, back in the eye of a child under five (see Sarcoma of the Chorioid) demands a careful examina-

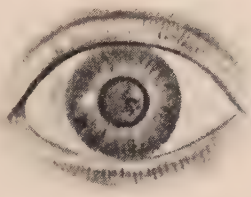

Fig. 52. Glioma (Axenfeld)

Fig. 53. Glioma, Early Stage (Adam)

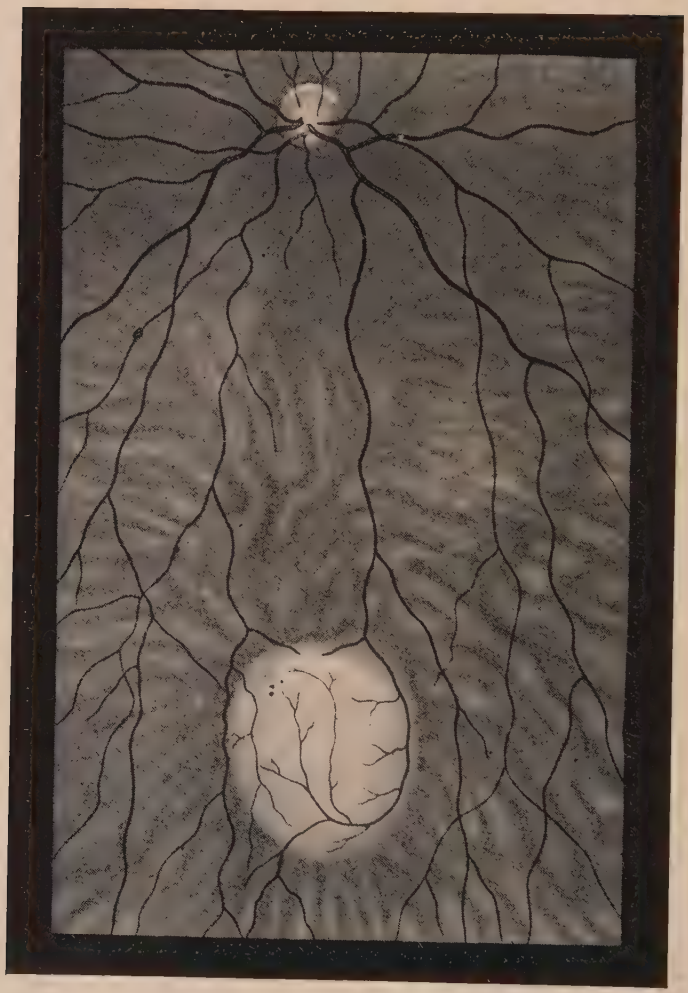

Fig. 54. Glioma, Early Stage (Haab)

tion to exclude, if possible, a Glioma. If the tension of the eye is raised, it is practically certain that it is Glioma. (Figure 52.)

Glioma in an Early First Stage:

In a few cases Gliomas have been seen as early as in the cut appended. Such a sharply outlined, protruding mass in the retina, in a young child under five, would cause you to suspect a Glioma at once. It is too circumscribed and has edges too abrupt to be a serous detachment of the retina. (Figure 53 and Figure 54.)

Remarks:

A Glioma might occur at the macula, in which case it would cause the child's eye to squint. This knowledge alone should lead us to instill drops and *examine the eye-grounds in all squinting children.*

Treatment:

Enucleation. Always examine the other eye before enucleation, since Gliomas are *in both eyes in eighteen per cent of the cases,* and many parents refuse their consent to a double enucleation. Recently Axenfeld claims to have destroyed a beginning glioma in an eye by means of filtered X-radiations.

CHAPTER V

Chorioiditis

In many cases it is not possible to say whether a lesion is in the Chorioid or in the Retina, and both membranes are often involved together (Chorio-Retinitis or Retino-Chorioiditis).

Fresh Chorioiditis, unless it affects vision, is not often seen, because it is painless. What we usually see are the old cases with white spots, due to exposed sclera and dark pigment around or in these spots. Chorioidal vessels may be coursing over the white spots as red or white lines.

The two greatest causes of Chorioiditis are Tuberculosis and Syphilis, and they often show as circumscribed lesions disseminated over the fundus.

Fresh Chorioiditis is *differentiated from Fresh Retinitis,* above all, *by the absence of hemorrhages* (see Retina).

DIFFERENTIATION OF FRESH FROM OLD CHORIOIDITIS:

Fresh Chorioiditis

Recent chorioiditic exudates are yellow or yellowish white, and have hazy outlines, due to œdema of the retina overlying the chorioiditic exudate.

Fig. 55. Disseminated Chorioiditis, Early Stage (Haab)

Fig. 56. Disseminated Chorioiditis
Older spots above; fresh spots below (Haab)

The chorioidal vessels are not seen, and a retinal vessel that happens to run over the exudate is either covered by the retinal œdema or bends forward as it passes over the chorioidal exudate that lies under the retina.

Old Chorioiditis

Old atrophic chorioidal spots are pure dull white, of irregular but sharp outline and often pigmented at their edges.

Chorioidal vessels may be seen as white or red lines in the spot, and retinal vessels course over the spot unchanged in level.

Disseminated Chorioiditis

Figure 55 shows an early stage, and Figure 56 shows a case with fresh spots below and older spots above in which pigment changes have begun. Figure 57 is an old case and shows the typical punched out spots.

Causes of Disseminated Chorioiditis:

Syphilis, both acquired and hereditary, is the commonest cause, and Tuberculosis is next; Anemia, Chlorosis, etc.

Treatment:

Constitutional. Mercury and potassium iodid in all cases; atropin and rest for the eyes in recent cases.

Disseminated Chorioiditis is a plastic or exudative type.

Suppurative Chorioiditis and Panophthalmitis

The mildest type of Suppurative Chorioiditis is a

Fig. 57. Disseminated Chorioiditis (Haab)

yellow exudate filling the vitreous (vitreous abscess). It runs a course with slight external signs of inflammation and leaves a blind eye. It has to be differentiated from a Glioma of the Retina, and has been called a Pseudo-Glioma, since it gives a reflex like a Glioma. (See next page.)

Panophthalmitis runs a violent course with exudates filling the vitreous and anterior chamber. The eye is pushed forward and its movements are limited.

Causes of Suppurative Chorioiditis and Panophthalmitis:

Ectogenous and Endogenous.

Ectogenous causes are penetrating injuries of the eye, perforating corneal ulcers, etc.

Endogenous causes are through septic emboli in puerperal fever, meningitis, especially in children, and suppuration of the cord. In rare instances, in acute infectious fevers, as scarlet, diphtheria and erysipelas.

Prognosis:

Hopeless.

Pseudo-Glioma:

(*a*) Eye softer.

(*b*) If atropin is instilled, the pupil frequently does not dilate evenly—that is, as a perfect circle.

(*c*) Any age.

True Glioma:

(*a*) Tension normal, or increased.

(*b*) The pupil dilates evenly.

(*c*) Under five years, as a rule.

If there is the least doubt, since such eyes are blind, enucleate.

Chorioiditis is often spoken of as peripheral and central, according to its location.

Peripheral Chorioiditis

Remember that Syphilis loves the periphery of a fundus. This is shown by the following:

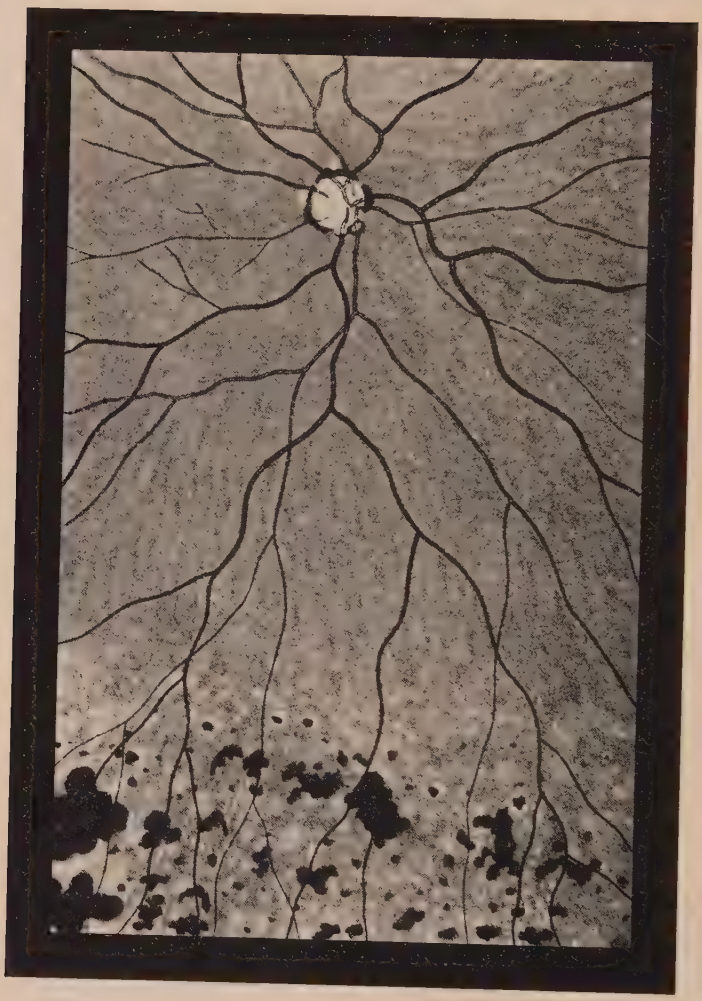

Fig. 58. Peripheral Chorioiditis (Haab)

(*a*) Practically every Interstitial Keratitis (a syphilitic disease) shows chorioidal changes in the periphery. (Figure 58.)

(*b*) Retino-Chorioiditis Syphilitica prefers the periphery (see Retinitis Pigmentosa).

(*c*) Black and white dots mostly in the periphery of a fundus are *pathognomonic of hereditary Syphilis*. This is called the "Salt and Pepper Fundus." It may be nearly all pepper and very little salt, as in the appended cut. I have seen it far out in the periphery of the fundus of three children, in the same family, all victims of hereditary lues.

Peripheral Chorioidal changes are by no means always syphilitic.

Central or Macular Chorioiditis

The causes are—

I. High Myopia. Figure 59 shows changes at the macula in High Myopia.

High Myopes are always in danger of two things:

(*a*) Hemorrhages and changes at the macula.

(*b*) Detachment of the Retina at any place.

The changes of High Myopia around the nerve-head and the macula, as depicted in Figure 60, often receive the name of "Myopic Chorioiditis."

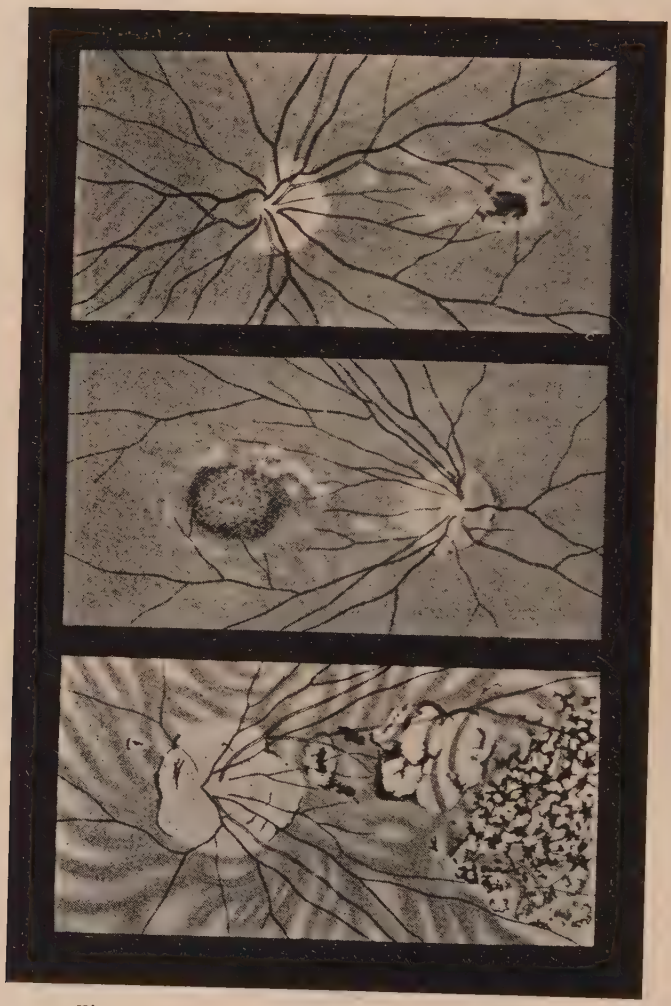

Fig. 59. Central or Macular Chorioiditis (Haab)

Fig. 60. Myopic Chorioiditis (Adam)

Diagnosis of Myopic Chorioiditis—

The presence of a temporal crescent (or circumpapillary atrophy), and white areas in the macula or periphery of a High Myope, determine, as a rule, the diagnosis. The pigmentation is usually limited in amount. (Figure 60.)

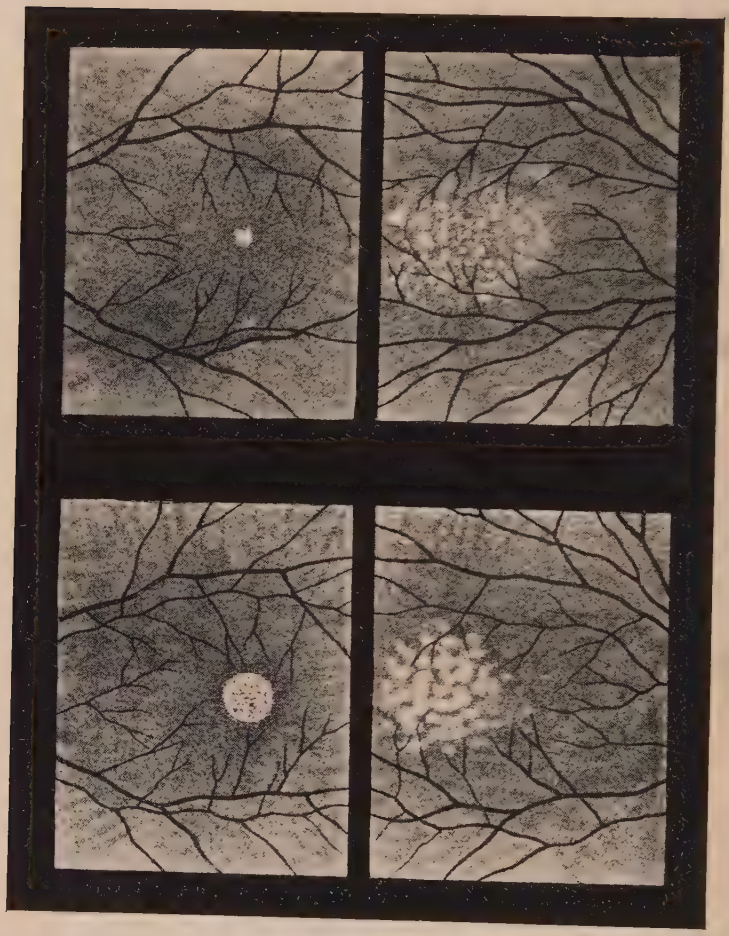

Fig. 61. Central or Macular Chorioiditis (Traumatic)
(Haab)

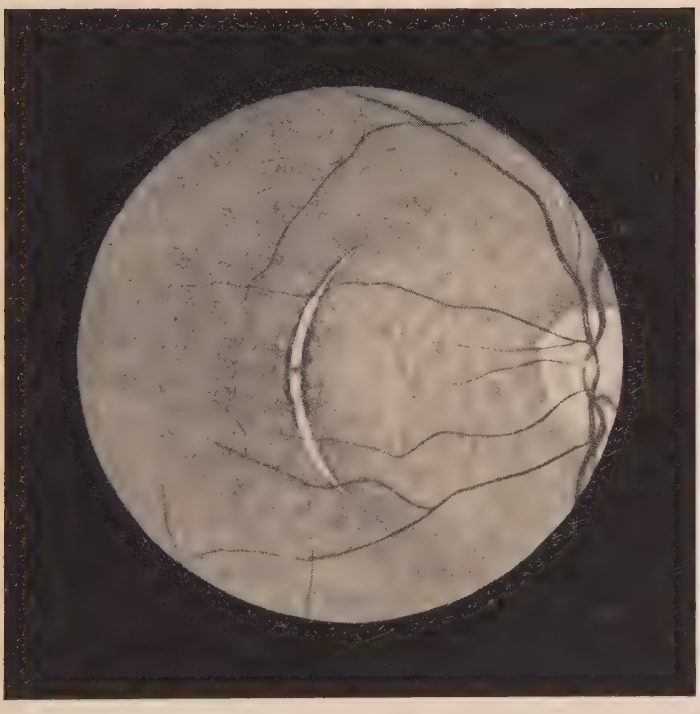

Fig. 62. Rupture of the Chorioid (Adam)

II. Central Senile Chorioiditis. This term is used to describe various fine changes at the macula in old people. The changes are manifold and difficult to picture.

III. Changes at the macula often follow blows on, or foreign bodies in, the eye (we have spoken of

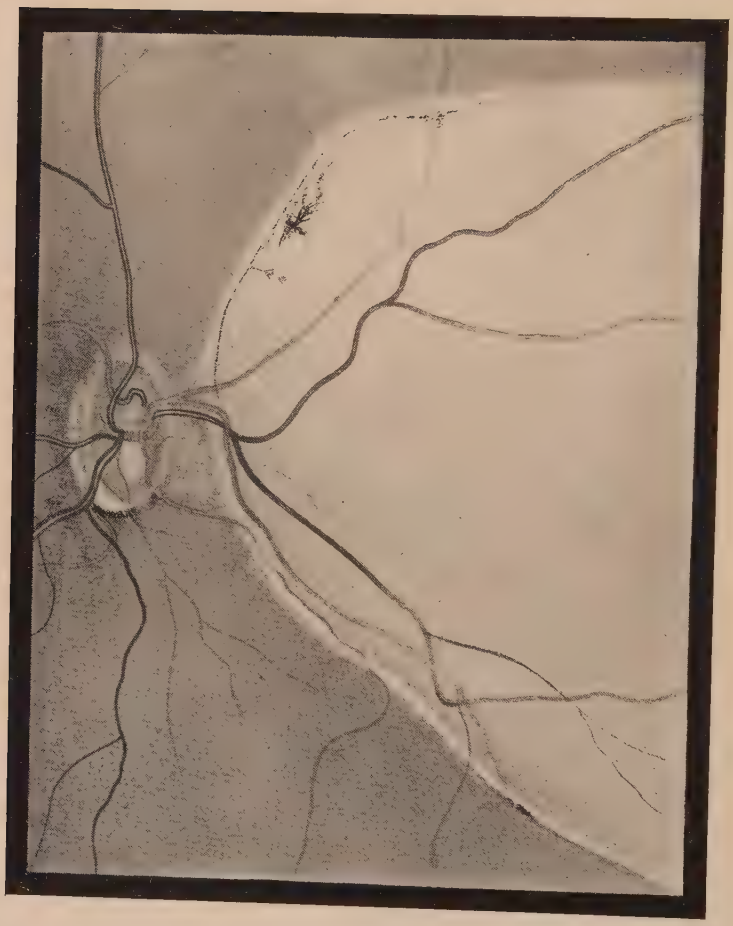

Fig. 63. Coloboma of the Chorioid (Frost)

Commotio Retinæ). In a few cases an actual hole or depression is present at the macula. Figure 61 shows some of the changes.

Rupture of the Chorioid

This is always caused by a blow on the eye and cannot be seen until the blood in the vitreous has absorbed.

The Picture:

A *whitish crescent,* concentric with the disk, over which retinal vessels run. Pigment usually borders the white area, and the mid-zone of the crescent is usually wider than the extremities. Many variations from the typical picture may occur. (Figure 62.)

Coloboma of the Chorioid

This is a congenital defect in which the Chorioid is absent and the sclera shows white over a large area below the disk. There is nearly always a defect in the iris below, causing a pupil shaped like a keyhole. The white area often runs to or includes the disk, and it often runs forward beyond the limits of the ophthalmoscope. (Figure 63.)

Tuberculosis of the Chorioid

This occurs as miliary tubercles or solitary tubercles.

I. Miliary or Disseminated Tuberculosis of the Chorioid.

The Ophthalmoscopic Picture:

Yellowish hazy patches in the posterior part of the fundus. These patches (tubercles) rapidly enlarge and show *no pigment changes*. The changes are not as common as formerly believed, but may prove of diagnostic aid in Acute Miliary Tuberculosis.

I have recently seen two such cases in adults with Tubercular Meningitis in the stage of coma. (Figure 64.)

II. Solitary Tuberculosis of the Chorioid.

The Ophthalmoscopic Picture:

It looks like a tumor and is to be differentiated from a Sarcoma of the Chorioid. Around the mass are often small yellowish-white chorioidal spots (tubercles), as shown in the figure.

It occurs in young people with chronic Tuberculosis and is very rare. (Figure 65.)

Sarcoma of the Chorioid

Occurrence:

It is the most common tumor of the eye. Most frequently observed between the ages of forty and sixty, yet it has been seen as early as the age of two and as late as the eighty-second year. The rule is that with a tumor in the eye, in a person under five years, we sus-

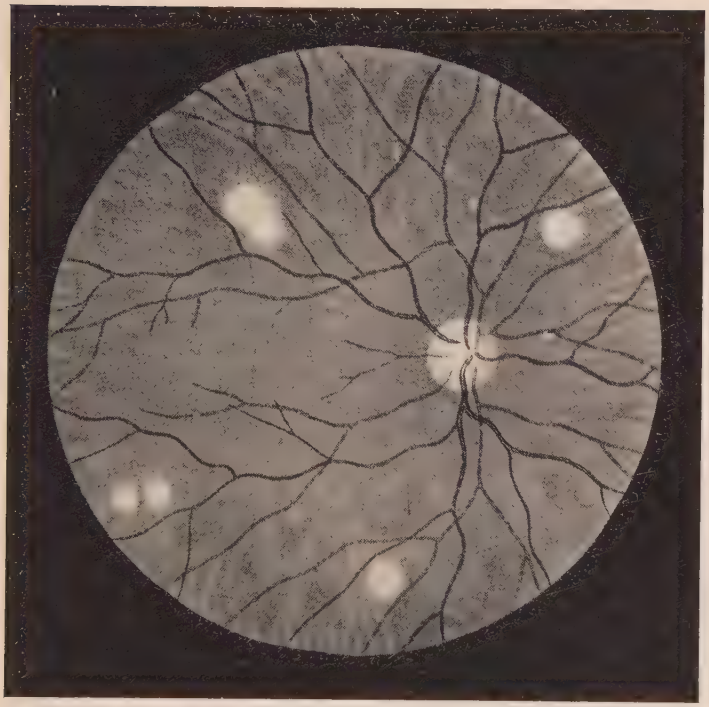

Fig. 64. Tuberculosis of the Chorioid (Haab)

pect the tumor to be a Glioma, and over five, a Sarcoma.

The stages of the tumor are four—

First Stage:

This is the stage of a detached retina, which we see with the ophthalmoscope. We cannot get light through it so as to illuminate the pupil with the transilluminator

Fig. 65. Disseminated Tuberculosis of Chorioid (Haab)

placed on the eye over the tumor, *because the solid tumor and not serum is under the detachment.* Other things that make a tumor detachment suspicious are the following:

(*a*) The retina is raised abruptly into the vitreous and has steep side-walls.

(*b*) Its location. A detachment above the disk is very suspicious, since most simple detachments are below the disk.

(*c*) The appearance is often of a dark slate color in a sarcoma detachment, because most sarcomas of the chorioid are melano-sarcomas.

Second Stage:

The patient comes to you for pain, because the tumor has caused Glaucoma. The eyeball is red, the pupil dilated and immobile and the eye is hard.

The diagnosis is difficult, but the history of slowly oncoming blindness and then pain, and *the transillumi-nator,* make it.

Third and Fourth Stages:

These refer to the extra-ocular stage and the stage of metastases in the liver or other organs.

Remarks:

The first stage is important, for the patient is becoming blind from a black area slowly encroaching on his vision. The patient has no pain, and the mistake of thinking it is a cataract may be made until the pain of the second stage drives him to seek advice.

The second stage is often diagnosed Hemorrhagic Glaucoma. It is Glaucoma, but Glaucoma with a tumor as the great first cause.

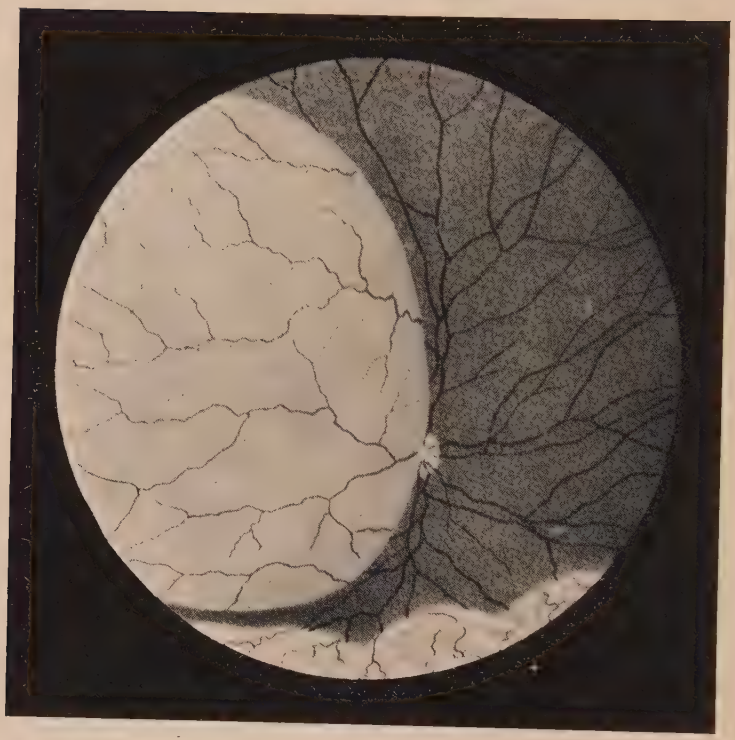

Fig. 66. Sarcoma of the Chorioid (Haab)

Treatment:

Enucleation in the first and second stages. Removal of entire contents of the orbit in the later stages.

Prognosis:

The earlier the enucleation, the more favorable. It

is gloomy even with early enucleation. Figure 66 shows a tumor and a serous detachment in the same eye.

Cataracts

Definition:

Any obstruction in the crystalline lens to the passage of the light from the ophthalmoscope is a cataract.

Diagnosis:

The *pupil must be widely dilated.* We use the Direct-Indirect Method. The opacity is situated in the pupil and looks black against the red fundus in case the cataract is not complete.

With a complete or total lens opacity, no red light is transmitted from the fundus.

An opacity, to be in the lens, must lie either on a plane with the iris or not deeper back than five millimeters (the depth of the lens). If it is deeper than that, it is in the vitreous.

Lens opacities are fixed, while vitreous opacities nearly always are floating.

Special Caution:

Never make the mistake of surmising a cataract because your patient is going slowly blind. Many cases with this history *are going blind from Glaucoma, Tumor, etc.*

I once saw a woman who had waited five years for

her cataracts to ripen. Her lenses were perfectly clear, but both optic nerves had total glaucoma cups and her vision was hopelessly lost.

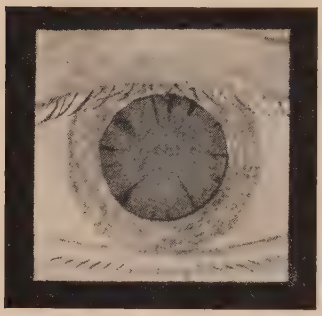

Fig. 67. Senile Cataract, Early Stage (Axenfeld)

VARIOUS KINDS OF CATARACTS:

Figure 67 shows the ordinary senile cataract in an early stage. The opacities are dark spicules extending towards the center from under the pupillary margin.

A congenital cataract, as a rule, looks like a round dark ring in the central portion of the dilated pupil.

Other kinds of cataracts are in the form of dots at the anterior or posterior part of the lens and in the center of the pupil (anterior or posterior polar cataracts). (Figure 68.)

With the focal illumination, cataracts look grayish-white or bluish-white. A few cataracts look brownish-red (black cataract).

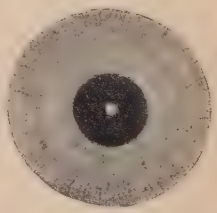

Fig. 68. Anterior Polar Cataract (Axenfeld)

Blindness from Non-use

(THE SQUINTING CHILD)

Deviating eyes rapidly lose useful vision. This oc-

curs so rapidly that an infant under one year of age with a constant squint in one eye will, in the absence of proper treatment, go blind in this eye within three months. A squint that develops at the age of two or three takes a few months longer to destroy useful vision.

All these infantile squinters can be saved from blindness if seen early.

The treatment is simple. Force the deviating eye to work by proper glassing, by occlusion of (or, better, by the use of atropine in) the non-squinting eye, so as to force the squinting eye to use and develop its macula, and by training with the stereoscope or amblyoscope when the child has reached the age of three to five years.

It is *criminal to tell a mother that her child will outgrow a squint or that she must wait until her child is old enough for operation.* The vast majority of squint operations are solely cosmetic—any useful vision having long since been lost.

The Fundus Picture:

The macula is "tantalizingly perfect," and, as von Graefe said years ago, it is a case "where the doctor and the patient see nothing."

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